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THE PALOUSE*

W. A. Rockie

Soil Conservation Service

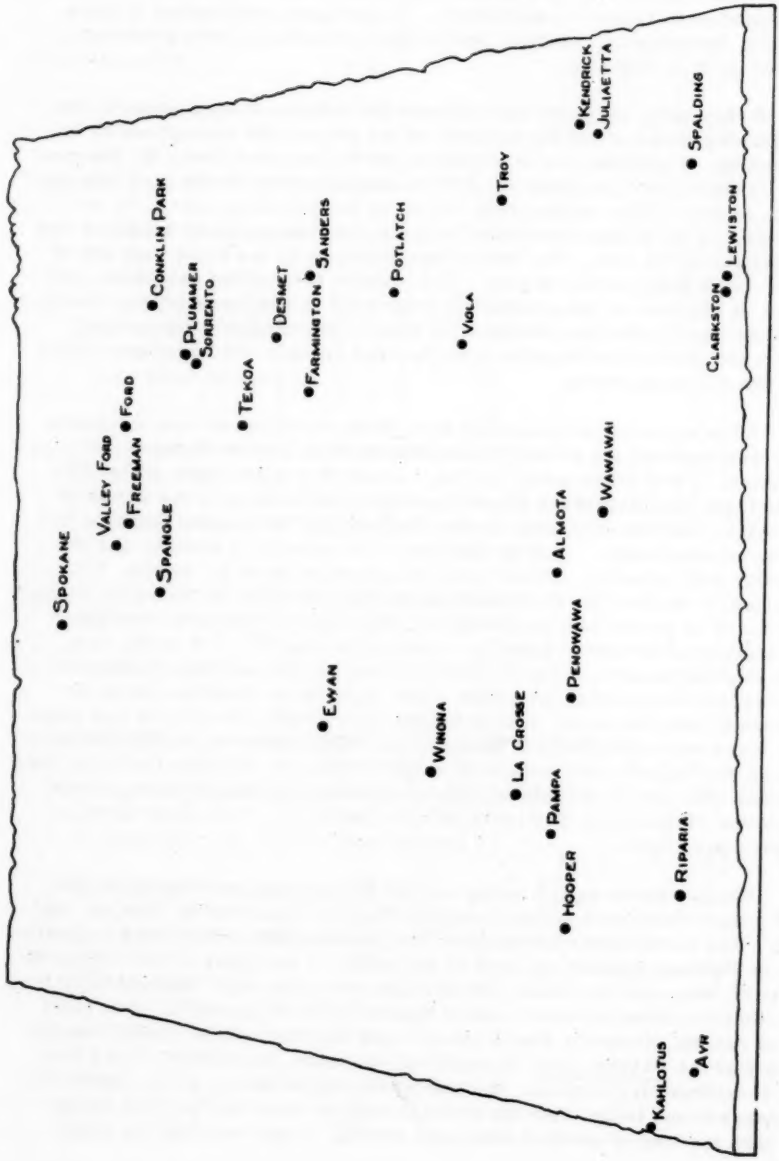
The Palouse is one of the unique land areas of the world. It has no counterpart anywhere, and so far as I have been able to learn, no other area of land even closely resembles it. Its peculiar combination of physiographic, topographic, edaphic, and climatic conditions have produced a land that is truly different.

Every early explorer who crossed the Palouse Region wrote in the most glowing terms about the wonders of the grasslands through which he was passing. I consider the description left by Governor Isaac W. Stevens' party, in their diary for June 19, 1855 as one of the most effective and the most accurate. They summarized it well in the following words: "I will again say, we have been astonished today at the luxuriance of the grass and the richness of the soil. The whole view presents to the eye a vast bed of flowers in all their varied beauty. The country is a rolling tableland, and the soil is like that of the prairies of Illinois."[1] Then, several days later, after they were in the dense forests of what is now northern Idaho, they still harked back to the Palouse area they had already left when their diary shows the following entry:

"The narrative of these last four days' travel shows how extraordinarily well watered the country is west of the spurs of the Bitter Root Mountains. I will state again, having crossed this great plain of the Columbia from the Chemakane Mission north of the Spokane to the mouth of the Peluse, that the difference in the character of the country on these two lines is extraordinary. A large portion of the country is arable, and is generally well grassed. There is no deficiency of wood for camps, yet occasionally the basaltic formations crop out of the ground, at which points the country is sterile and uncultivable. But under the spurs of the Bitter Root Mountains the whole country is arable, the soil as rich as the best prairies of Minnesota, wood for fires and timber for building." Even after they had left the prairies far behind, they must still reminisce about the grasslands they had seen. One is forced to conclude, from these and many other diary entries by each of the several main exploring parties which crossed the Palouse that, under its virgin cover, the Palouse really thrilled everyone who saw it. Similarly, the area makes me marvel today, even though that virgin cover and those natural conditions, have been in large measure destroyed.

Twenty years ago, I thought of the Palouse as including all of the more humid wheatlands in the Columbia Basin of Washington, Oregon, and Idaho. The justification for my previously calling that much more extensive area as Palouse appears obscure to me today. I may have simply taken the say-so of others at that time. Or it might have been that I egotistically desired that the name include as many square miles as possible. The most logical reason, however, that I can now see for that larger broader boundary is that the Palouse soil, theoretically at least, is common, and I may have considered it prevalent, throughout the entire larger area. However, it appears to me today, that the Palouse soil no more typifies this larger area than any one of several other soil series. I now feel that the name

*Presidential address of the Association of Pacific Coast Geographers, Santa Barbara, California, June 18, 1953.


SPOKANE
VALLEY FORD
FREEMAN
FORD
SPANGLE
CONKLIN PARK
PLUMMER
SORRENTO
TEKOA
DESMET
FARMINGTON
SANDERS
POTLATCH
VIOLA
TROY
KENDRICK
JULIAETTA
SPALDING
LEWISTON
CLARKSTON
WAWAWAI
ALMOTA
PENOWAWA
EWAN
WINONA
LA CROSSE
PAMPA
HOOPER
RIPARIA
KAHLOTUS
AVN

LAND FORMS OF THE PALOUSE

Palouse should be limited to a minor fraction of that area.

Boundaries

The boundary delineated by Meinig (1950), in my opinion, provides better boundaries than any other yet described.[2] The bounds of the Palouse Prairie by Clements and Shelford (1939) and those of the Palusian Biotic Province by Dice (1943) are not too different, but they are not the same.[3] My suggested boundary was arrived at, in my mind, at least ten years ago, and it so happens that it coincides exactly with that proposed by Meinig. We arrived at the same conclusion wholly independently of each other. This area lies mainly within a 90-mile equilateral triangle pointed by Spokane, Washington on the north, Kendrick, Idaho on the southeast, and Kahlotus, Washington, on the southwest. More specifically, its perimeter is not far from each of the following towns and stations (named clockwise): Spangle, Valley Ford, and Freeman, Washington; Ford, Conklin Park, Plummer, Sorento, Sanders, and DeSmet, Idaho; Tekoa, and Farmington, Washington; Potlatch, Viola, Troy, Kendrick, Juliaette, Spalding, and Lewiston, Idaho; Clarkston, Wawawai, Almota, Penawawa, Riparia, Ayer Junction, Hooper, Pampa, La Crosse, Winona, and Ewan, Washington.

Nature has made natural boundaries which separate this area from adjoining lands almost all of the way around its perimeter. The old front line of the continental ice sheet marks its narrow northern tip, the forested mountains make most of its eastern boundary, the precipitous north rim of the Clearwater and Snake River Canyons marks the southern boundary, while the southeastern edge of the Channelled Scablands makes a sharp western border. These natural boundaries exclude all of the islands of Palouse-like land which lie within the Channelled Scablands.

Within this area, all of the people who reside therein consider that they live in the Palouse, whereas very few who live outside these boundaries consider their lands as Palouse. Some of the folk who live in the eastern portion of the scablands may consider themselves as residing within the Palouse, but they are really in the Channelled Scablands. The only places where the word Palouse shows outside these boundaries on any maps I know is the Palouse River in the mountainous headwaters to the east and in the scablands to the west. As bounded here, the Palouse has a gross area of about 1,750,000 acres, of which approximately 1,500,000 are cropland.

Climatic Notes

The area has a modified maritime climate in the cooler months and a hybridized maritime-continental climate in the warmer months. The winters are typically cloudy and usually relatively mild with considerable rain or snow. Severe cold waves may occur, however, and in occasional years may last for weeks. Strong southwesterly winds, high humidity, and temperatures generally in the thirties further characterize the usual winter. The summer days are generally clear and warm, with maximum temperatures in the 80's. The summer nights are usually cool with minimum temperatures around 50 degrees. Little or no rain occurs during the summer months. The precipitation ranges from about 12 inches, along the western margins, to around 22 to 25 inches along the eastern border next to the mountains. The seasonal characteristics are quite similar, however, whether the annual precipitation is 12 inches, 18 inches or 24 inches.

Geologic Notes

In the long-distant past, the land area that is now within the Palouse which I have delineated was more or less a peneplane or coastal plain extending westward from the mountains on the east. Then came the period when lava flowed over the greater part of the inter-mountainous portions of the Pacific Northwest. These flows covered all of that peneplane to considerable depths (still largely unknown), except for an occasional monadnock which projected above the level of the basaltic flows. Steptoe Butte is one of these. This Columbia basalt, as it is known, provides a firm and unusually uniform base beneath the present Palouse region. The frequence of faults and folds in these basaltic flows and the amount of post-flow erosion on its surface are relatively unknown quantities, because of the currently almost wholly buried position of that basalt. However, enough is known to be reasonably certain that the basaltic flows do not have an unbent simple horizontal structure.

Following the coverage by basalt there occurred the deposition of a mantle of silt or silty clay. This still unconsolidated cover has a common depth of not less than 75 feet, with a probably maximum depth of 200 to 250 feet. We have some evidence that this mantle of silt and silty clay consists of two distinct formations, a thin overlying veneer, and a thicker basement section. The upper one is typified by the more mellow loess-like material found mainly on those Palouse hills which are high enough to form the skyline. The second is typified by the red clay points which are always several to many feet below that skyline level. Whether this deep mantle of soil is a wind or water deposit is in dispute. I believe the upper loess-like and thinner layer is chiefly and probably entirely an aeolian deposit, and that the lower more clayey underlying deposit is mainly and possibly entirely sedimentary material. This description gave us the Palouse in the raw.

Nature's processes, since that time, have been further modifying this unconsolidated soil mantle. Ever since the deposits were laid down, wind has been very slowly but surely building up the top of the leeward slopes and erosion has been carving a dendritic drainage pattern into its surface. Snowdrift action, nivation, and possibly even local microscopic glaciation have combined further to produce the unbalanced Palouse hills which are so universally characterized by the steeper leeward slopes. Meanwhile, climate has been developing a distinctive soil profile on the exposed surface, and the flora and fauna have both been adding organic matter to the topsoil. Leaching has acted further to carry some of the organic content and some of the colloidal clay content, to deeper levels.

Then, by one bold stroke, nature provided the so-called Spokane flood which washed away the entire soil mantle from most of the area that is known today as the channelled scablands. The thousands of draws and minor drainage lines are entrenched to various depths into this mantle, whereas the main drainage lines are generally entrenched clear through the soil mantle and down into the underlying basalt. In the western portion, especially, they are eroded hundreds of feet into the rock, frequently becoming box-canyon-like in nature.

Soil Notes

The soils in the Palouse include both the separate and mixed products of many physical processes. Loessial, snowdrift, nivation, lacustrine,

alluvial, glacio-fluvial, and possibly even other of nature's processes are represented. They are sufficiently heterogeneous that both hearty and widespread disagreement as to their manners of formation exists.

The different soils do occur in a roughly parallel series of north-south bands. This banding is principally resultant from (1) the increasing humidity as one goes eastward and (2) increasingly finer soil particles as one goes eastward. They range from the soils of the Ritzville series which barely touch the western edge of the Palouse, through the Walla Walla, Athena, Palouse and Thatuna series respectively to the mountainous lands along the eastern edge. The first four of these developed under prairie conditions, but the last evolved beneath a forest cover.

Topographic Notes

The area is a rather completely dissected plateau, rising in elevation from 1,500 to 1,800 feet along its western edge to about 2,600 to 2,800 feet along its eastern border. It has virtually no undissected upland but, strangely, also has relatively few alluvial bottoms. The land is nearly all sloping. The Palouse hills always make me think of sand dunes and, when viewed from certain angles and under certain special conditions, they look very much like dunes. From countless measurements, it is well known that the south and west slopes are universally of more gentle gradient than are the north and east slopes. Though the former average less than 20 per cent and never exceed 35 per cent slope gradient, the opposite sides of the hills always show a maximum gradient of not less than 40 to 55 per cent. From many aspects, the leeward amphitheaters look almost as if they had been scooped out. It is not entirely inconceivable that they are really tiny cirques formed by midget glaciers on the leeward slopes during the last Ice Age. The local relief in any 160 acres is usually from 100 to 200 feet.

Since there are many hilltops and many amphitheaters per square mile over most of the Palouse, the general effect is one of dune-like topography. The topography appears especially striking when seen from a plane or from some high eminence. The effect is even further accentuated when looking in a southwesterly direction or when the snowdrifts are at their maximum.

Several crystalline-rocked buttes, all older than the basaltic flows, break the sameness of the Palouse landscape. Steptoe Butte, which rises about a thousand feet above the Palouse farmland is to the Palouse region what the Black Hills are to their encircling lands. It is a real landmark! Kamiak Butte, Wildhorse Butte, and many others are much less prominent features on the Palouse landscape.

Notes on Land Use

The word Palouse has been said to have originated from a French word, meaning "a grassy place". Less than 100 years ago, the Palouse was one vast wavy sea of grass-covered hills. The area was practically treeless, although the projecting buttes and a few of the steeper north slopes supported some pines and firs. A fringe of trees and shrubs, chiefly chokecherry, hawthorn, willow, and cottonwood usually marked the occasional waterway, and here and there scattered clumps of these and other shrubs broke the endless sea of grass. Several species of bunch grass predominated in the landscape, with balsamroot, Indian paintbrush, lupine, and yarrow providing most of the floral display.

Today all is changed and the sea of grass is gone. By diligent search, one can find remnants of the old cover in every part of the area, but the total acreage is negligible. Almost every tillable acre within the Palouse is under cultivation, most of the scabland to the west is used for range, and the mountains on the east provide both timber and grass. When farming first started here 70 to 80 years ago, wheat immediately became the leading crop, and, except for a few years during and after World War II, when peas temporarily took first place, it has always been the leading farm crop.

Until about 1930, crops were grown only every other year, in alternation with summer fallow. Under this system of farming, the land suffered excessive tillage, the soil became too finely pulverized, half of the organic content of the soil was lost, and the soil particles ran together, puddled too readily. Unwittingly farmers were doing their level best to destroy their land at the most rapid rate possible, the very opposite of their well meant intentions.

Inevitably, sheet erosion became their dominant farm problem, and in 1930 I started specific research in the area looking toward the control of this newly recognized threat to the permanence of agriculture. That research has continued during the twenty-three years which have passed, and we are now seeing a new and safer system of farming gradually taking over in the Palouse.

Conservation Farming Practices

We soon found that the summer fallowing principle was one of the main causes of the sheet washing that had become so prevalent in the Palouse. The primary reason lay in the fact that at the time in late spring when the past year's stubble field was plowed to start the summer fallowing operation, the soil was already nearly saturated from the rains which had fallen during the rainy winter season just ended. Under fallowing practices of several summer cultivations of the land, the soil in the Palouse fallow field retained most of its stored water in the soil right through the hot dry summer months. When the wheat was seeded that fall, the winter rains began almost simultaneously. The soil became fully saturated with the first rains and the newly-germinated wheat plants used scarcely any water before the following May. Of most of the 10 to 15 inches of water that fell on these already wet lands, very little could soak in. Therefore, much and in some years most of it ran off the surface, usually carrying large quantities of soil with it.

The Palouse farmlands need to be cropped every year! This change to annual cropping is a first step in the control of the erosion problem.

Another almost universal custom of Palouse farmers was the burning of their grain stubble in the fall after they had removed the crop. This ill-advised practice is now almost entirely eliminated, although it has taken nearly twenty-five years to reduce the precentage of burning from 99 plus down to from 5 to 7 per cent. Instead of burning, the stubble is most effectively used and is of the greatest value toward the maintenance of the soil when it is tilled partly into and partly on top of the ground. Its primary value on top of the ground is the protection to the surface against sheet washing. Good stubble mulch, as this is called, is being increasingly used by Palouse farmers.

The most valuable single practice toward erosion prevention and improved soil conditions is the practice of green manuring. When this practice has been repeatedly applied to the land, it not only greatly increases crop yields (about 50 per cent more total crop over a period of twenty years), but it also eliminates the chief cause of sheet washing in the Palouse, namely the physical breakdown of the soil. Contour farming on all sloping lands is a supplemental practice which reduces sheet washing. Grassed waterways and farm ponds also prove highly valuable to the changed farming operation. Sprinkler irrigation, chiefly on the creek bottoms which extend across the Palouse like "shoestrings", is further advancing and stabilizing Palouse agriculture. Dozens of additional farmers are adding this practice to their other conservation practices with each passing year, and they are universally pleased with the results. Alfalfa is the usual crop grown and the water is pumped from drilled wells, many of which are artesian.

Palouse farmers, using these conservation practices, and producing annual crops, can not only maintain, but greatly increase their agricultural production of wheat, peas, alfalfa, sweet clover, barley and other crops for any number of centuries ahead. Because of the specific nature of conservation farming, livestock naturally becomes a major part of the operation on an average Palouse farm.

When all Palouse farmers actively follow the principles included in these several conservation practices, the area will be adequately protected from erosion and its farmers will realize approximately twice the income they have been making under the currently obsolete, but still followed, exploitive farming of yesterday. It has always been a good place to live, but they they will make it a much better place to live.

I believe the Palouse is the only major non-irrigated farming area in the United States which has never had a crop failure!

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(This paper was somewhat revised after Mr. Rockie's departure for Africa, and he has not had an opportunity to review the editorial changes.)

THE TIN CAN INDUSTRY IN CALIFORNIA

Glenn Cunningham

American Can Company

California is the leading food canning state in the Union. Canning, until World War II the state's largest industry, is familiar to all students of California economy. Less familiar is the important auxiliary industry, the manufacture of metal containers, familiarly known as tin cans. This industry itself is of considerable size, and employs nearly 10,000 persons at peak season.[1] It creates an annual product valued at more than $200,000,000, and meets the state's requirements of more than six billion metal containers per year.[2]

Canning Industry Background

The association between can manufacture and canning is obvious. The latter determines the size, the fortunes, the location, and the very existence of the former. However, the two are separate and distinct industries. Let it be clear that this paper treats only the manufacture of cans, and not any phase of canning or food packing. At one time the association was even closer than it is today. In the early history of food packing, cans were manufactured in each individual cannery by slow and laborious hand methods. This was true of the earliest canneries in California, the salmon canneries on the Sacramento River and the fruit canneries in San Francisco, San Jose, and Oakland. Later the industry moved away from the canning activity and into specialized can manufacturing plants. In 1901, the era of big mergers in American business, the tin can industry followed the national trend and this period saw the emergence of American Can and Continental Can, the two companies that still lead the national industry. Locally this was accomplished by the merging of existing small companies in San Francisco, Los Angeles, and San Jose. Today most of the cans in use are made by those and other specialized can companies. Exceptions are found in some of the larger soup and condensed milk companies which manufacture their own cans.

Tin can manufacturing began in California in 1862 when the first tin plate was imported from Great Britain by way of Boston and Cape Horn.[3] Probably less than 100,000 cans were made that year, all of them by hand. By 1870 the annual production had increased to 3,000,000; by 1900 it was slightly under 100,000,000, and by 1930 had surpassed one billion cans per year. The current annual output is over six billion, or about five times the entire output of the 19th Century.

The market for this huge output, is of course, the canning plants, of which several hundred exist in the state. Most important of the products canned are the perishable, seasonal foods. California packs more than one-fourth of the nation's vegetables, more than half of the fruit, and more than half of the fish of continental United States.[4] Thus California is not only the largest food canning state, but also the nation's largest producer of food cans. The annual tuna pack alone needs 400,000,000 cans. Peaches fill 425,000,000 cans, and tomato products in the state require 1,100,000,000 cans each year. Also important are the scores of non-seasonal and specialty food products, baked beans, spaghetti, and Chinese and Spanish foods. Although not subject to the canning process in the technical sense of the word, some 200 other foodstuffs are packaged in cans, the list embracing items from honey and chocolate syrup to candy and salted nuts.

A second large market is the enormous quantity of industrial products, edible and otherwise, that are increasingly packaged in tin cans. The brewing centers canning beer, the meat packing centers with their meat products and by-product lard and pet food, the port cities where coffee and spices are received and packaged, the motor-oil refining centers and the paint manufacturing centers--all become consumers of tin cans. Over one billion cans per year are required by these and the hundreds of other products outside of the perishable food class. Hundreds of types and sizes of containers are manufactured for this endless variety of product. These range in size from the tiny spice and meat-spread cans, familiar to every housewife, to the 110-pound drums used for lard and various industrial products.

Can Manufacture

The so-called tin can actually is less than one per cent tin. Some have no tin at all, but most are made from tin plate, a product of the steel mill, where coils of strip are cold rolled until reduced to a thickness of one one-hundredth of an inch, then coated with a layer of tin of microscopic thickness by either a hot-dip or an electrolytic process.

The process of manufacturing a tin can is relatively simple but, being almost entirely automatic, requires a complex series of machines, collectively known as a "can line." The sheets of tin plate, after receiving a coating of enamel, if the product for which they are destined requires it, are cut into pieces of the proper size and shape for the type of can to be produced. These blanks, as they are called, are notched to allow a smooth overlap, are rolled into shape, the edges hooked, and the seam soldered, creating a one piece cylinder. Both ends of the cylinder are then flared out by a flanger in preparation for the top and bottom pieces that have been stamped out on other machines and lined with a sealing compound. The bottom end is double-seamed on by a closing machine at the can factory. The can is then tested and is ready for shipment. The tops are sent with the cans to the canner and fitted on with a similar machine after the cans have been filled.[5]

Can factories usually have more than one can line and may have a dozen or more, perhaps producing different types and sizes of containers, often at a rate as high as 450 per minute. The necessary machinery is intricate and costly, thus obviating very small scale production. A fairly large market must be assured before the establishment of a can line is warranted.

There are 16 can manufacturing companies in California operating thirty-four different plants. Largest of the companies are American Can Company with nine plants and the Continental Can Company with six. Other multi-plant companies are Pacific Can Company with five, and United Can and Glass with two plants. Six other companies each operate one can factory; six packers of food or other products manufacture cans entirely or partially for their own use.

Plant size varies from the small, single-line factory employing only a score of workers, to the huge Los Angeles plant of the American Can Company, among the largest in the country, and employing about 1,500. The larger plants operate as many as twenty lines and rate a capacity of one and one-half billion containers a year, or approximately five million units a day. Varying degrees of labor skill are required in the manufacturing process. Normally about eighteen per cent of the employees in the tin can industry in the state are women. Average employment for the year is

approximately 7,700.[6] Average total wages surpass $33,000,000.

Distributional Factors

Seasonality is unavoidable in an industry which ultimately serves a seasonal product. Unlimited storage of cans manufactured in the off-season for use in the peak season is impossible but a certain amount of storage reduces the problem. Many canneries themselves try to offset the problem of seasonality by canning non-seasonal products during the winter. Thus the demand for labor and other facilities, as well as the demand for cans, is leveled off somewhat. Employment in the tin can industry in 1952 varied from a low of 6,700 in January to a high of 9,900 in September. These months roughly correspond with the high and low season of fruit and vegetable canning, but the variation in employment levels is far less.[7] The seasonal peak load requirements are met by "floaters" hired temporarily, or in the college towns, by students whose vacation period corresponds with the period of peak employment. There are sufficient non-skilled jobs in the factories so that the lack of experience and skill on the part of these temporary employees is no great handicap.

Can plants are located in 21 California communities. It is the market for cans, that is, can using establishments, that determines the location of can manufacture. The empty tin can is bulky, relatively low in value, and more costly to transport than is the equivalent amount of tin plate, the raw material. Cans then, are manufactured near the areas of canning activities. Those areas that immediately come to mind are the important deciduous fruit centers of the Sacramento, San Joaquin, and Santa Clara valleys, the citrus region of Southern California, and the widespread vegetable producing areas led by the Great Valley with its tomatoes and spinach, and the Delta Region with its asparagus. Also familiar are the fishing centers of San Pedro, San Diego, and Monterey, and the milk surplus areas of the San Joaquin and the Salinas valleys.

But once more it must be remembered that these centers of primary production are not the only consumers of metal containers. The hundreds of packers of non-seasonal and specialty foods, of beverages, of meat products, and a host of industrial products, mean a demand for cans in the manufacturing centers of the State, principally the San Francisco-Oakland and the Los Angeles metropolitan areas. It is the many activities of the farmer, the fisherman and the manufacturer that account for the pattern of distribution of tin can plants--a pattern nearly as widespread as are the sources of products that finally go into tin cans.

Distribution of Can Manufacture

The thirty-four can factories are distributed as follows:
The San Francisco-Oakland metropolitan area leads with ten plants in six different communities, San Francisco, Oakland, San Leandro, Emeryville, Hayward, and Fruitvale. In metropolitan Los Angeles there are nine plants located in six communities namely, Los Angeles, Vernon, Wilmington, Terminal Island, Hawthorne, and Fullerton. Three plants each are claimed by the metropolitan areas of Sacramento, Stockton, and San Jose, one of the latter being in Santa Clara. Modesto has two plants, and one is found in each of the following communities: San Diego, Monterey, Salinas, and Gustine in Merced County.[8]

The distribution of the state's production among these several centers varies from year to year, but in general can be described as follows: The San Francisco-Oakland metropolitan area accounts for about thirty per cent of the volume and the Los Angeles metropolitan area for about twenty-six per cent. These two with one-half of the state's business, are followed by Sacramento and San Jose, each with about fifteen per cent, and Stockton with eight per cent. Modesto has perhaps two per cent, and the remaining four per cent is distributed among the other four single-plant communities.

As one might expect, there is the logical association between the type of can production in these areas and the leading products of the regions. Thus the plants in Sacramento, Stockton, San Jose, and Modesto produce cans for fruit and vegetable products. Those in Monterey, San Diego, and the Los Angeles harbor area are producers principally of seafood cans. Those in Salinas and Gustine, and one of the Modesto plants, manufacture cans for condensed milk only. In the Los Angeles and San Francisco-Oakland metropolitan areas, production is for these and other food stuffs as well as for the many general line items. Some production is highly specialized, one plant each producing beer cans only, paint cans only, and only cans for animal food.

Until 5 years ago all of the tin plate had to be shipped from the east, principally from the Pittsburgh, Pennsylvania, Gary, Indiana, and Birmingham, Alabama, areas. Shipments to the west, even to coast points, were largely by rail, only occasionally by sea.

Since the opening of the tin plate mill of the Columbia Steel plant in Pittsburg, California, a major share of the plate used in Northern California comes from that source. This plant, a subsidiary of U. S. Steel, receives the coils of plate from Geneva, Utah, cold rolling and plating the product in California. The tin platemill of the Fontana plant of the Kaiser Steel Company, just recently opened, has not yet reached full capacity. Southern California can plants are supplied in part by it, but still receive a fair amount of plate from eastern points.

California consumes about 700,000 tons of tin plate annually. Between 65 and 70 per cent of the requirements are supplied by the two California mills. The capacity of these mills is theoretically sufficient to meet all state requirements, but actually there are special types of plate and special sizes of sheets that are not produced locally and must be imported from eastern plants specializing in those products.

Most land deliveries of tin plate are by rail. Less than five per cent go by truck, and those are shipments to nearby plants only.

The finished containers are delivered either by truck or by rail. Perhaps forty per cent are packed in paper carriers or cartons and shipped by truck, the remainder being shipped by rail, usually in bulk in paper lined box cars. The choice depends in part on distance and rates, in part on convenience, or customer ownership of trucks.

The industry is not confined to California markets alone but produces for markets throughout the western states and some overseas areas. Elsewhere in the west there are can factories in Oregon, Washington, Utah, and Hawaii. These however, are equipped to produce a limited number of types and sizes, and those required in smaller batches are apt to come

from California plants. For example, California supplies beer cans for the small breweries of Utah, Arizona, Colorado, and Northern Mexico, such items as syrup cans and odd size paint and industrial product cans for the Pacific Northwest, citrus juice cans for Arizona, coffee cans for Hawaii, and tuna cans for Peru.

A few odd sizes and types of cans required locally are not produced in California plants and must be imported. These come largely from Illinois.

California production represents about one-sixth of the nation's total. Although the state leads in the production of food cans it falls far behind some of the eastern and midwestern industrial states in the production of non-food cans, and in total volume is second to Illinois.[9]

Of the total produced in the United States, about two-thirds are food cans and one-third non-food cans. The ratio in California is about six to one in favor of the food cans, the state producing 19 per cent of the food cans and only 7 per cent of the nation's non-food cans.[10]

Between the industry census year of 1947 and the year 1951, the California tin can industry increased about 75 per cent. Since the canned food industry increased less than 50 per cent over the same period, the increasing importance of non-food items is suggested.[11] With the growing industrialization of California and the constantly enlarging list of products that are packaged in metal containers, the continued growth of the state's metal container industry seems assured.

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2. These, and many of the following statistics, are calculated from unpublished data in the files of the American Can Company.

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7. Average monthly employment in fruit and vegetable canning in 1952 varied from 28,060 in January to 95,497 in August.

8. Since presentation of this paper the American Can Company plant in Monterey has been closed, and construction has started on a new Pacific Can Company plant in Santa Clara.

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POST-GLACIAL DRAINAGE CHANGES IN THE DARNLEY BAY AREA, N. W. T., CANADA*

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Darnley Bay is north of Great Bear Lake and midway between the Mackenzie and Coppermine Rivers which flow north into the Arctic Ocean. The three rivers which drain the area, namely the Brock, Hornaday, and Horton Rivers, are inaccurately shown on the latest 8 mile topographic sheet which was published in 1945, but a new and accurate map prepared from aerial photographs will shortly be available.

Darnley Bay was discovered by Dr. John Richardson in 1826[1] but part of the inland area is still largely unknown. The mouth of the Horton River was discovered by Richardson and the river itself explored by Vilhjalmur Stefansson and Rudolph Anderson in 1909-12.[2] A. J. Stone, an American naturalist collecting for the American Museum of Natural History, discovered the Hornaday River in 1898.[3] Until recent years the large size of the Hornaday River was unsuspected and it was considered to be a small stream rising from a lake 10 miles south of Darnley Bay, when in reality the river is about 200 miles long and the lake does not exist.

The southern party of the 1913-18 Canadian Arctic Expedition explored the Brock River for 23 miles from its mouth.[4] Air photographs show it to be some 80 miles in length.

The purpose of this paper is to discuss some of the post-glacial drainage changes which have occurred in the drainage basins of the Brock, Hornaday and Horton Rivers in the Darnley Bay area. Field work was done in the summer of 1951 and liberal use has been made of photo interpretation in extending the study to include a larger area.

General Description

The Darnley Bay region is in the barren grounds or tundra beyond the tree limit which lies close to the Horton River. Permanently frozen ground or permafrost is usually within five feet of the surface, except in areas of coarse granular materials. The area straddles the western boundary of the Canadian Shield which is shown on present geologic maps as reaching the coast at the southern end of Darnley Bay just east of the mouth of Brock River. In reality, the boundary should be shifted to the northeast because there is an area of Tertiary (?) sediments which are exposed northeast of Brock River and outcrop in an area of over 100 square miles.[5]

The entire region was glaciated, and morainic material blankets most of the bedrock within 30 to 40 miles of Darnley Bay (excluding Parry Peninsula) but large areas of bedrock are exposed at the surface farther inland. Evidences for two directions of ice movement approximately at

*Based on field investigations carried out for the Geographical Branch, Department of Mines and Technical Surveys, Ottowa, with whose permission this paper is published. Thanks are due to Keith Fraser for his assistance in the field.

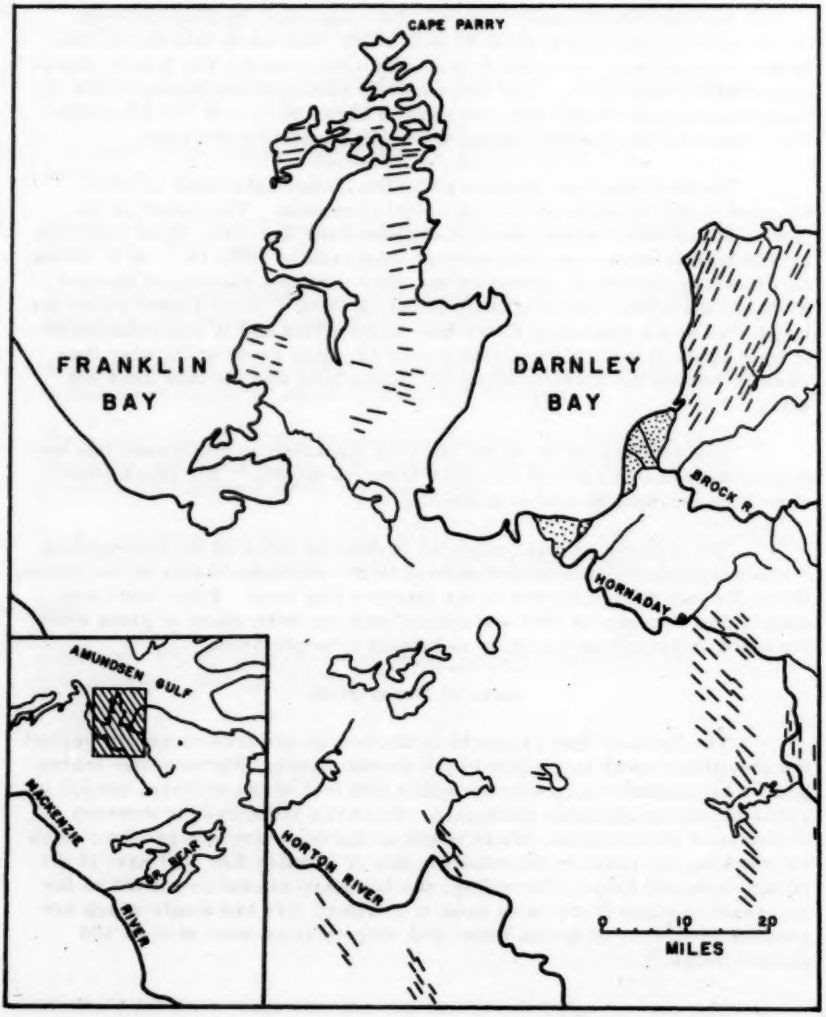

Figure 1. Map of Darnley Bay area showing glacial lineation in ground moraine and bedrock with inset map to show general location

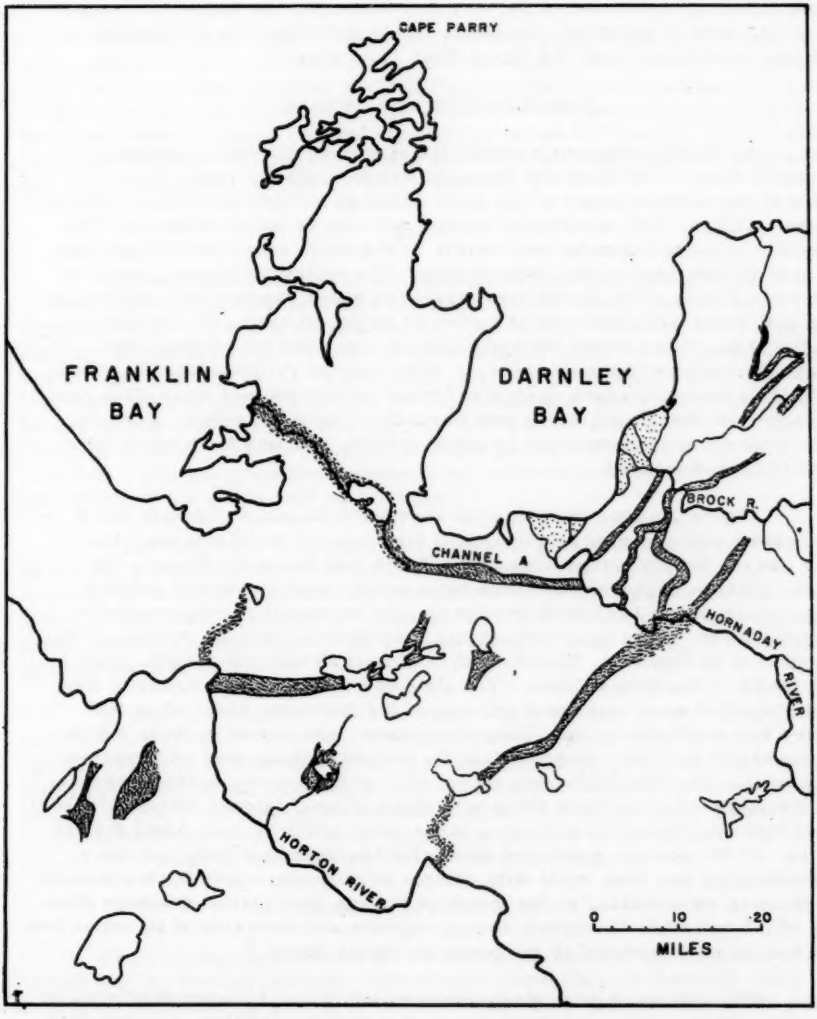

Figure 2. Map showing the principal post-glacial drainage channels. Dashed boundaries have been used to delimit drainage channels about which there is some uncertainty.

right angles to each other occur in the terrain. A general east-west trend is apparent across Parry Peninsula changing to a northeast-southwest trend on the east side of Darnley Bay. This movement coincides with that of no known ice center. The other principal direction is found south and southeast of Darnley Bay where the ice moved from south to north, with a westerly component. This direction is a continuation of the projected trend from the Great Bear Lake area.[6]

Post-Glacial Stream Capture

As deglaciation progressed, the streams followed in general the regional slope of the land and drainage was in a chaotic state. It is possible to reconstruct much of the early drainage pattern from the evidences given by large, dry, abandoned valleys and also by misfit streams. The former drainage channels are broadly U-shaped in cross profile and tend to have distinctly concave lower slopes. The valley sides may preserve intricate flights of scalloped river terraces which suggest that solifluction and soil creep have not been as active as might generally be assumed to be the case. Some of the channels contain elongated serpentine lakes, present remnants of former rivers. The sizes of the abandoned channels with their meander scars show that former river volumes were often comparable with that of the Brock and Hornaday Rivers of to-day. Former lake bottoms are represented by sand, gravel, and clay flats which have locally been dissected.

Figure 2 shows the principal abandoned drainage channels which were formerly occupied by rivers and streams. It is evident that flow was across the present valleys of the Brock and Hornaday Rivers, the lower courses of these two rivers being established by stream capture. Piracy was due to headward erosion and not to lateral cutting or subsurface methods.[7] The most interesting post-glacial drainage channel is that labelled A on figure 2. The channel is almost 80 miles in length, equal to the length of the Brock River. The flow was westward into Franklin Bay and channel A once took the discharge of the Hornaday River when the latter was a tributary. Dr. John Richardson, who sailed past the mouth of channel A in 1826, observed that the soil was wholly mud and apparently alluvial. In 1909 Stefansson travelled past the former mouth of channel A and observed a big bight filled with many alluvial islands strewn with willows that might have come from a large river which he soon found did not exist. If the western portion of channel A has been correctly located--identification has been made with oblique photographs--both Richardson and Stefansson were looking at the mouth of a large post-glacial drainage channel which had been abandoned through capture and diversion of its water into the course now occupied by the lower Hornaday River.[8]

The amount of post-glacial erosion which has been accomplished by the three large rivers and their tributaries is quite striking, because flow ceases or is reduced to a minimum during the long cold winter.[9] In early summer, when melting of the snow is rapid and the ground begins to thaw, the rivers and streams swell in volume and accomplish most of their erosion. The Brock River has cut a box canyon into Pre-Cambrian sandstones and dolomites to a depth reaching 400 feet and a length of 10 miles. The debris has been transported seaward to form its large arcuate delta which measures 13 miles along its seaward margin and covers 30 square miles--all this for an 80 mile long river.[10] The Hornaday River has cut a canyon at least 15 miles long and 300 to 400 feet deep. In its upper course the river flows sluggishly in a broad valley several miles wide, the valley prob-

ably being that of a glacially enlarged pre-glacial or inter-glacial river valley. The Horton River has entrenched itself with broad meander loops for a distance of 50 miles from its mouth and further upstream it has cut several canyons into massive limestones and dolomites.

Stream capture which has occurred frequently in the past will probably continue to occur in the future. For example, the divide of the Horton River lies some 10 miles south of Darnley Bay but the waters of streams originating near the divide must flow more than 200 miles through the Horton River system before reaching the Arctic Ocean at Franklin Bay. Eventually the short swift streams flowing north into Darnley Bay will encroach upon the drainage of the Horton River system.

Lakes

Although many lakes are constantly disappearing through a lowering of their outlets and by subsurface drainage, a few small lakes are still being formed. New lake development is insufficient in numbers to balance losses. Extensive areas of exposed lake bottoms occur in the Darnley Bay region, particularly in the region south and west of Franklin Bay. The old lake bottoms are typically broken up into rectangular polygons measuring twenty feet or more across and separated by water-filled channels. The polygons show up clearly on aerial photographs on a scale as small as 1:35,000. The polygons are frequently saucer-shaped with low centers and belong to the depressed center type.[11]

A few lakes are forming as thermokarst phenomena through melting of tabular horizontal sheets of clear ground ice. The ground ice may be five feet or more in thickness and is found in some ill-drained floodplains.[12] If the ground ice melts, oval to circular thaw pits form like kettle holes and these usually fill with water. As further collapse takes place, the ponds may enlarge and coalesce.

Ground ice mounds, like bun-shaped hillocks five to ten feet high, may form at the outlet end of lakes. Although they are probably the result of seepage and freezing of lake water, some of the mounds might conceivably originate in poorly drained flats and eventually impound drainage to form small lakes. At least two pingos, which are conical mud hills with ice cores, occur in the Darnley Bar area.[13] The pingos may reach a height of some tens of feet and are found in former lake bottoms and ill-drained areas.

Summary and Conclusions

The drainage systems of the Brock and Hornaday Rivers have been established by stream capture. The rivers in the Darnley Bay area have eroded post-glacial gorges up to 400 feet deep since deglaciation. The preservation of many high level terraces suggests that soilfluction has not acted with as much rapidity as the name of "soil flow" might imply. The bottoms of many drained lakes may be broken up into rectangular polygons. A few new lakes form by the melting of ground ice.

Postscript: Further study of air photographs strongly suggests that the Horton River formerly emptied into Harrowby Bay (a part of Liverpool Bay) some 25 airline miles northwest of the present mouth. The length of the river was shortened by about 50 miles when the undercut slope of a meander loop breached the narrow strip of land separating it from Franklin Bay. The same event may occur again, because two large meander loops of the river, which is incised to a depth of several hundred feet, lie only a short distance from the sea.

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10. The delta is built by a river whose inflow into the ocean is less dense than the ocean water. In early summer (June and July) the river waters melt the sea ice in front of the river's mouth before the ice in Darnley Bay breaks up. Presumably in the deltas of the Brock and Hornaday Rivers are examples of Bates' hypopycnal deltas. C. C. Bates, "Rational Theory of Delta Formation," Bull. American Association of Petroleum Geologists, Vol. 37, 1953, pp. 2119-2162.

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LOCATIONAL CHANGE IN THE DOUGLAS FIR LUMBER INDUSTRY

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During the last quarter-century the Pacific Northwest Douglas fir lumber industry has been characterized by two dynamic features. First, its percentage share of total national softwood production has steadily increased. Second, during this interim significant locational changes have occurred, to shift the center of production into Oregon.

Regional Significance of Lumber Production

Since 1925, the spread of the lumber industry southward from Puget Sound to western Oregon has been a major economic trend within Pacific Northwest regional economy. In 1925, Oregon and Washington were producing jointly 9,500,000,000 board feet of Douglas fir and other minor associated species of softwood lumber, or twenty-eight per cent of total United States softwood output. In 1950 this area produced 10,600,000,000 feet, or thirty-eight per cent of national softwood output.[1] The two-state region in 1950 had a milling system comprising 1,538 sawmills, employing a labor force of 44,000 which was paid over $508,000,000 for lumber valued at $782,000,000.[2]

In the regional economy Douglas fir lumber manufacturing is second only to agriculture. It furnishes a base for other valuable wood products industries such as plywood, pulp and paper, shingles, and furniture. It supports a growing transportation service industry, trucking, railroading, barging, and rafting employed to bridge the ever-increasing space between mills and forests, and between mills and lumber markets. Lumber production is watched closely by industrial analysts as an index to both economic and regional trends.[3]

Nature of Locational Change

In the past eighty years the American lumbering center moved from New England to the Great Lakes, and thence to Puget Sound. It now has turned southward to western Oregon. Today, two southwestern Oregon counties, Lane and Douglas, are the paramount producers of Douglas fir, whereas in 1925, Grays Harbor and Snohomish Counties in Washington were the leaders.[4]

The Washington lumber decline and the rise of Oregon is now a trend familiar to bankers, lumbermen, and labor associated with the industry. Washington reached peak output in 1926 with 6,800,000,000 board feet. Thereafter it declined gradually and yielded leadership to Oregon in 1942. Expansion of large and small mill capacity reached boom proportions in southwestern Oregon during World War II. Post-war strength of the lumber market increased Oregon production in 1950 to 7,000,000,000 board feet, double that of Washington.

Decline in Western Washington

A comparison and graphic mapping of lumber capacity of key centers as of 1924 and 1947 reflects these marked changes and the degree of intra-regional shift. (figure 1) Tidewater-located mill sites on the Puget Sound, and Washington coasts, where the first large commercial export

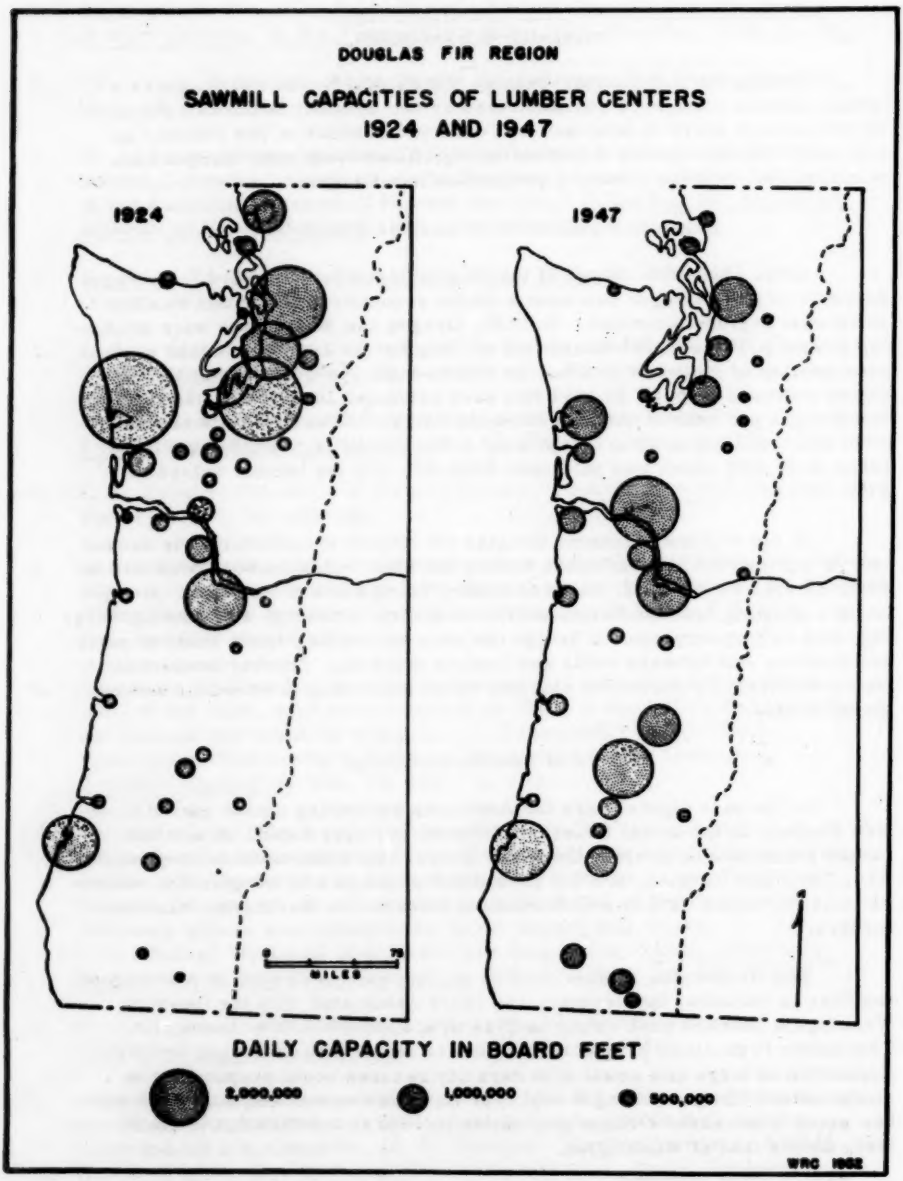

Fig. 1. Significant changes in the location of sawmilling capacity has occurred in the Douglas fir region. Note the decrease in the Puget Sound basin and the Grays Harbor district since 1924 and the expansion in the lower Columbia River district and southwestern Oregon. Source: West Coast Lumbermen's Association, 1949-1950 Statistical Yearbook.

sawmill centers were established prior to 1910, all decreased in capacity and in production.

Until the forest-depletion factor greatly increased the procurement costs for sawmill logs, the Puget Sound and coastal harbor sites were optimum. Raw material could be obtained cheaply and plentifully from the rim of Puget Sound and the banks of the navigable rivers which penetrated the dense lowland forest. Lacking modern heavy yarding and hoisting machinery and logging railroads, the tidewater mills almost entirely depended on rafted and water-transported logs. These sites were also the most accessible by ship and coastwise lumber schooners which, prior to 1910, moved the major part of the output.

The Grays Harbor district, with the navigable Chehalis River penetrating its forest hinterland and two lumber cities on tidewater, Hoquiam and Aberdeen, was the leading center in 1924 with an output of 1,300,000,000 board feet. By 1947 the district had declined seventy-eight per cent to 303,000,000 board feet per year.

The Tacoma area, loud claimant to the title, "Lumber Capital of the World" decreased seventy-nine per cent, from 1,000,000,000 board feet in 1924 to 267,000,000 in 1947. All other mature sawmilling centers and lumber ports on the Sound including Seattle, Everett, Anacortes, Port Townsend, and Bellingham had decreases ranging from forty-six per cent in Seattle to eighty-two per cent in Bellingham, the northernmost of Washington lumber cities.

The southward migration of lumber capital and labor has caused a population decrease in certain local areas. Grays Harbor County is an example, decreasing over ten per cent, and losing 7,000 people by out-migration, principally of families supported by lumbering employment. The lumber cities of Aberdeen and Hoquiam, Washington, had a joint decline of 5,000.[6] Many rural precincts and towns in western Washington primarily based on forest utilization have been partly depopulated. McKenzie, in 1928 recorded population decline in thirty-eight incorporated places in the Puget Sound region.[7] In a later study, Cross demonstrated also the extent and causation of lumber town abandonment.[8]

Longview, on the lower Columbia, was the only center which escaped the general western Washington decline. Favored by good shipping and log-rafting access, as well as by location close to a large undepleted forest reserve in the Washington Coast Range and the Cascade Mountains, this new river port was planned primarily for sawmilling. Here was invested the largest installed lumber capacity, over 3,000,000 feet daily, ever concentrated in one particular site in either Washington or Oregon.[9] Production at Longview increased 56 per cent from 1925 to 1949; it is currently the leading lumber center in western Washington.

Expansion in Oregon

Prior to 1920 western Oregon forests lacked good rail and road access, and coastal harbor facilities were not well-developed. Capital accumulated in the Puget Sound basin was not attracted to this relatively isolated forest region. However, the technological improvements in lumber transport, and in mechanized and motorized logging, and gradually rising market prices for logs and rough lumber made Oregon forest operations more attractive after 1920. Population growth in California and the

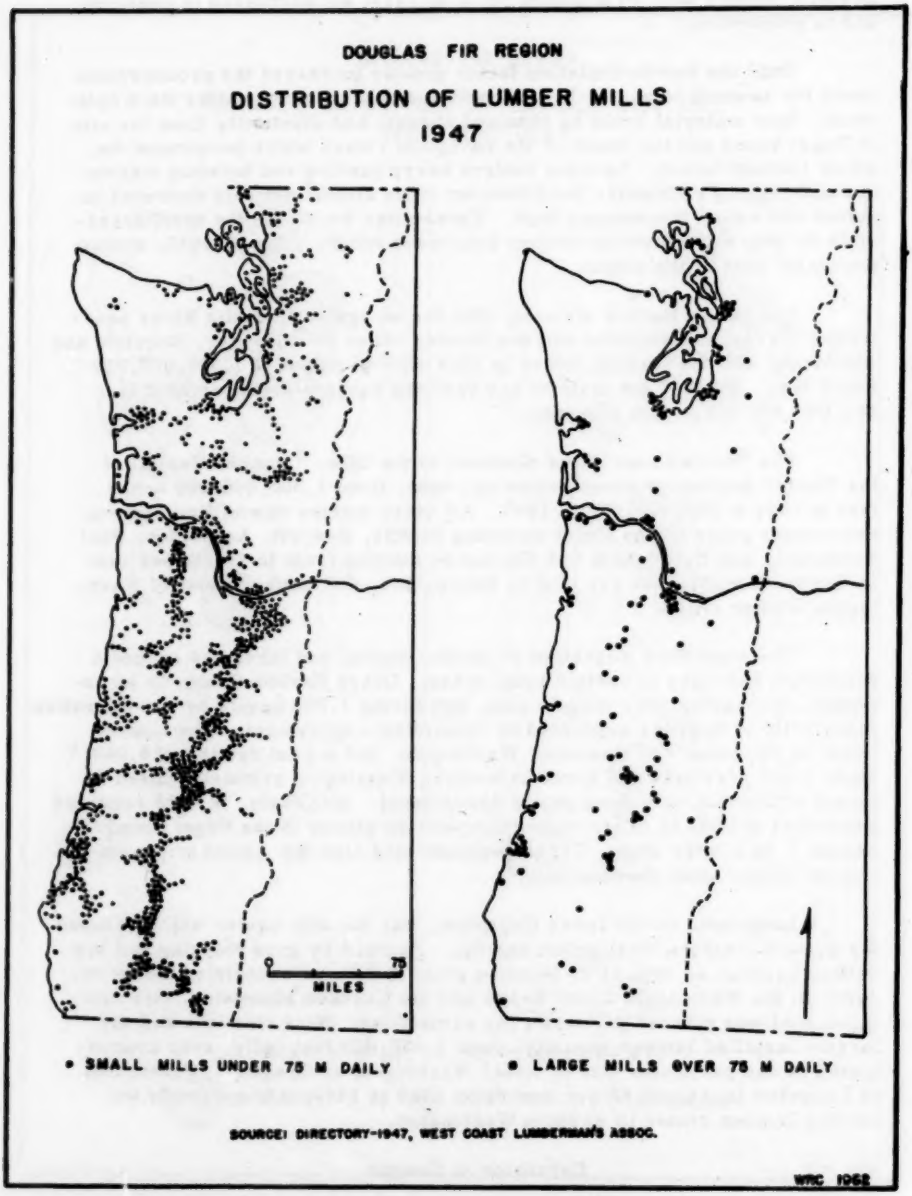

Fig. 2. A high density of small and large lumber mills has been established in the Cascade and Coast Range piedmonts of western Oregon. Close proximity to abundant and low cost timber and good railroad and road access to markets have caused a build-up in Oregon. Mill distribution density in Washington is less because of commercial sawtimber depletion. Source: West Coast Lumbermen's Association, 1947 Directory of Lumber Mills in the Douglas Fir Region.

strengthening of the coastwise lumber trade gradually made it profitable to open up the Oregon Coast Range, Klamath Mountains, and Cascades to logging and sawmilling on a large scale. The inadequacy of western Washington to fulfill wartime softwood demands from 1940 to 1950 swelled the expansion in Oregon at an unprecedented rate.

In 1925, Lane County, Oregon, was producing 285,000,000 feet per year; within 25 years it was a "lumber boom district" with an annual cut of over 1,000,000,000 board feet. Douglas County, in southwest Oregon, increased output ninety-five per cent for the same period. The Coos Bay-North Bend area, on the Oregon coast, expanded from 381,000,000 to 700,000,000 board feet per year.

Expansion of lumbering with its consequent demands for labor has affected population trends in southwestern Oregon. Lane County's population more than doubled from 1930 to 1950, increasing from 54,000 to 125,000.[10] Eugene, which grew from 19,000 to 36,000, is now a major lumber center. Sharp population increases have also occurred in Douglas and Coos Counties.

Installed Capacity Changes

The annual directories issued by the West Coast Lumbermen's Association lists the addresses and the installed capacity in board feet of all mills in the Douglas fir region. A comparison of the directories for 1924 and 1947 reveals a significant shift in location from weste n Washington to western Oregon. Large mills in western Washington, those units capable of producing 75,000 board feet per eight-hour day, have been scrapped or moved, about half of the capacity listed in 1924 having disappeared from the directory for 1947. (see figure 1.) The latter index shows that new and modern capacity increased more than fifty per cent on the Columbia River and in western Oregon. Several of the major lumber corporations which developed in the older Washington sections moved entirely to Oregon, or established their principal branches there.

Small mills producing under 75,000 feet daily have shown an even greater tendency to move southward. The migration of small, so-called "gyppo" operators with portable equipment, from Washington to Oregon increased greatly during World War II. Self-employed loggers and portable mill men moved by scores from the large cut-over of southwestern Washington into the Eugene and Coos Bay areas. There has been a locational shift of twenty-three small mill outfits from Lewis County, Washington, alone. In 1947 mills operated by five to ten men had reached a high degree of density in the piedmonts of the Coast and Cascade Ranges in Oregon. (figure 2.)

Timber as a Locational Factor

The location, accessibility and ownership of timber is a primary locational factor for sawmills. Before 1925, Douglas fir logs were plentiful and cheap; the log market was a buyers' market throughout the region. Increasing depletion, however, at the rate of over 5,000,000,000 board feet annually in privately owned forests of Washington eventually necessitated the relocation of many mills nearer new timber reserves.

Procurement costs, stumpage, logging, and trucking in Washington mounted as distances between mill units and forests increased. Logging

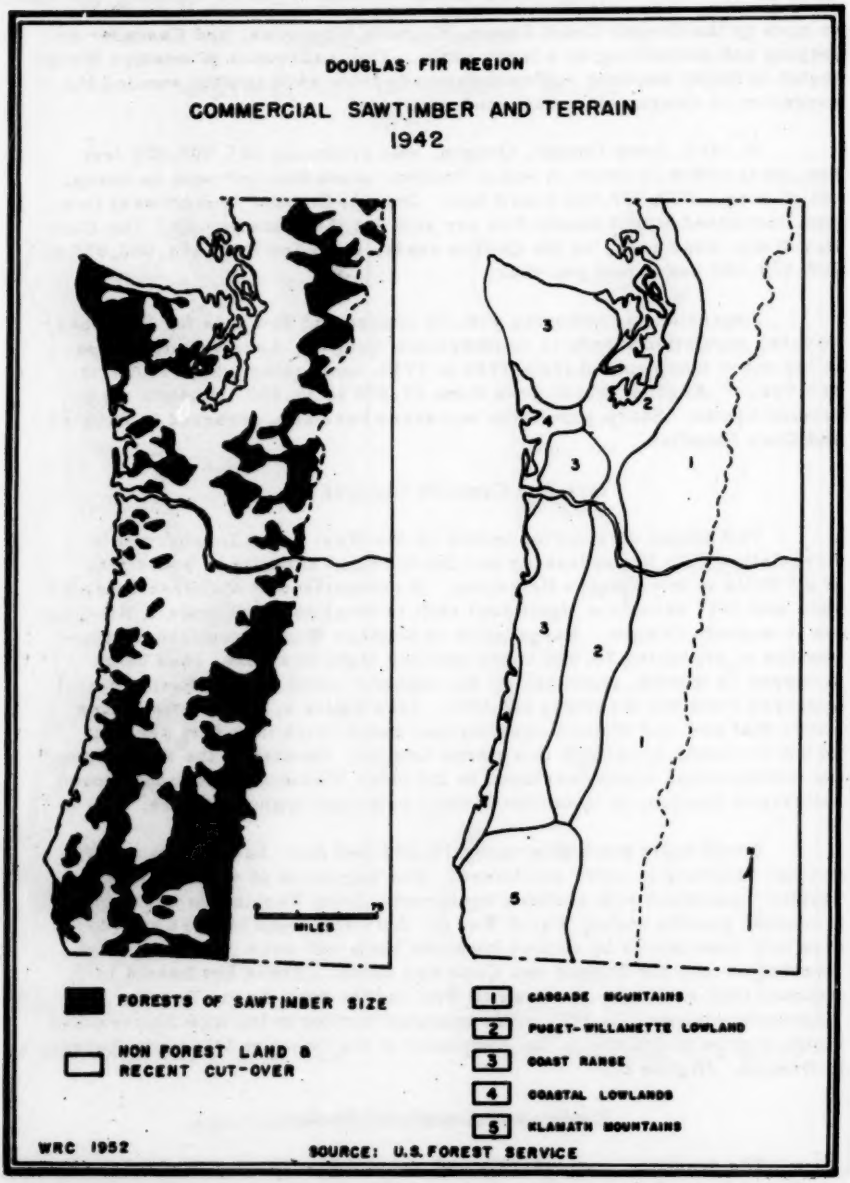

Fig. 3. Oregon has a larger commercial sawtimber reserve than Washington. The remaining reserve in Washington is largely in national forests and parks in the Olympic and Cascade Mountains where cutting is restricted to small amounts and is in difficult terrain. A large amount of the Oregon reserve is privately owned and readily available for harvesting. The terrain is also less difficult for modern logging. Source: U.S. Forest Service, Region 6, Portland, Oregon. 1942 Data.

was pushed far inland from the Sound and Grays Harbor, into rough Olympic and Cascade Mountain districts with consequent increased costs in railroad and road access construction as well as in truck transportation. Mountain logging was more costly in the higher terrain above 2,000 feet; it was also seasonal, being interrupted frequently, or closed entirely as heavy winter rainfall and snowfall in the mountains immobilized tractors and trucks.

In Grays Harbor and around the Sound large logs were needed for profitable operation of the tidewater mills; these became more expensive and their procurement irregular. Log shortages were partially solved by an increased federal timber-sales policy in the Olympic, Mount Baker, Snoqualmie and Gifford Pinchot National Forests. Total federal timber sales, less than 1,000,000,000 feet per year from all these publicly owned forests, were inadequate to supply an operating capacity of over 5,000,000,000 board feet in Washington. In addition, the bids for large national forest timber sales were competitive, large and efficient corporations generally outbidding smaller logging and sawmill operators. Both large and small logging and milling enterprises, squeezed out of the competition for national forest stumpage and unable to pay the rates asked for scarce privately owned timber, found relief and opportunity by migrating to Oregon.

Timber Availability in Oregon

In 1945, the U. S. Forest Service estimated that western Oregon had a Douglas fir reserve of 300,400,000,000 board feet.[11] (figure 3.) Washington was found depleted to 204,000,000,000,000 of which 78,600,000,000 feet was in national forests and 90,000,000,000 in private ownership. However, this latter amount is largely in corporate ownerships generally unavailable for sale to small logging and lumbering enterprises.[12] It is managed carefully by its owners on a limited yield basis in order to sustain large mill units in Longview, Tacoma, Everett, Bellingham, and Grays Harbor.

In Oregon there is a privately owned Douglas fir reserve of 111,000,000,000 board feet. Significantly, there are many small forest land holdings, and voluminous amounts of stumpage available at lower prices than in Washington. This situation accounts for the large number of small mills in western Oregon as of 1947. (figure 2.) With a truck, logging caterpillar, and a portable sawmill plant, the average small mill enterprise has been able to profit from low-cost access to privately owned timber.

Changes in Markets

Much of the present pattern in the industry has been oriented to new markets. In Oregon, new investments have profited not only from more economical access to timber, but also from closer location to California--now the leading market for Douglas fir lumber. Coastwise shipping of this building material from the Oregon coast to San Francisco, Los Angeles, and San Diego has greatly increased in the last twenty years. Rail and truck shipment from the Oregon interior to the Great Valley of California expanded. In contrast to earlier decades when most of the bulky lumber traffic was waterborne from Puget Sound to many Pacific ports, today over seventy-five per cent of the cut reaches domestic consumers by rail and truck.

Market trends indicate that sawmill sites on the Columbia and in western Oregon are more advantageously located than those farther north. Since 1930, the older maritime lumber centers on Grays Harbor and the Sound have suffered a decreased export to Asia and Australia. Their coastwise shipping to California and through Panama Canal declined as a result of inability to compete against the f. o. b. price of lumber at Coos Bay and the Columbia River.

In the increased volume of railed and trucked lumber to California, southwestern Oregon has a distinct locational advantage. Improved highway facilities and trucking equipment have surmounted the Klamath and Siskiyou Mountain barrier between Oregon and the Sacramento Valley. California now takes fifteen per cent of the Douglas fir output and a new market is growing in Oklahoma, Texas and the winter wheat belt. [13]

Summary and Conclusions

Since 1925 a major shift in the locational pattern of the Douglas fir lumber industry has occurred. Forest depletion and increased cost of the raw material is a principal cause of decline in western Washington. New centers on the Columbia River and in coastal and interior western Oregon have expanded in capacity and in production during the last twenty-five years. The shift from western Washington has caused population decline in numerous rural and urban areas of Washington and marked population increases in Oregon.

Expansion in Oregon has been favored primarily by more plentiful and cheaper raw material from privately owned timber lands. The Oregon section of the industry is also better situated for rail, truck, and water export of lumber to domestic markets, particularly to California and the Southwest.

Oregon will undoubtedly continue the focal area of lumber production for some decades. The northern regions have become increasingly dependent on federally owned national forest reserves in the Olympic and Cascade Mountains where logging costs are high.

Further decline is in prospect for western Washington. Increasing restrictive factors are high procurement costs and competition for logs created by timber scarcity and mountain logging at the limited rates of harvesting required under Forest Service sustained yield policy. Some foresters predict that when Oregon becomes depleted near the end of the century, Douglas fir lumbering will return to western Washington to utilize the second crop now growing on millions of acres of old cut-over land.

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WATER RESOURCE POLICY IMPLICATIONS OF THE HELLS CANYON CONTROVERSY

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The implications of power policy are of paramount concern to the Pacific Northwest because of the magnitude and importance of the hydroelectric resources, both developed and potential, in that region. In May, 1953, Secretary of the Interior Douglas McKay issued a statement, dealing with the Hells Canyon controversy, which may turn out to be the most significant power policy decision since the federal government undertook development of the Tennessee Valley program and Grand Coulee Dam. The potential policy implications of the statement are of primary importance both to the Pacific Northwest and to water resource programs in general, and warrant careful examination. Before examining some of the basic implications, it will be well to review briefly the issue on which Mr. McKay had to make a decision.

Statement of the Case

The Hells Canyon issue is complicated from all standpoints: political, economic, hydrologic, and engineering. Those, and there are many, who see it in simple black-and-white terms are indeed fortunate. Many arguments, and myriads of figures, have been advanced both pro and con. Much of the argument has been irresponsible, and much of it is not pertinent.

Stated simply, the question is this: should the Hells Canyon reach of the Snake River be used for one of the six large reservoirs recommended as part of the comprehensive federal plan for development of the Columbia River, or should the same reach of the river be used by the Idaho Power Company for a smaller development which will meet the needs of the company's market area in Southern Idaho. The rather general assumption that the issue is a controversy between public and private power is an oversimplification which ignores the difference in the size and objectives of the alternative proposals. In a broad sense, the conflict is between a project serving regional needs and one serving the needs of a section of the region; in other words it poses the issue of regional vs. local development.

The federally-proposed Hells Canyon project would be a high dam, as large as Hoover Dam on the Colorado River, with a reservoir having a usable storage capacity of 3,880,000 acre-feet, three-fourths as much as Grand Coulee. The power plant would have an initial installed capacity of 800,000 and ultimately 900,000 kilowatts. Water released from the reservoir for power production would be used at this plant and at eight downstream run-of-river power plants if the comprehensive plan is executed, for a total continuously available power contribution of over 1,000,000 kilowatts, nearly half that of the gigantic Grand Coulee project. At present, one of the downstream plants is completed (Bonneville) and two are under construction (McNary and The Dalles). Four, not yet started, would be on the Lower Snake, and the eighth, John Day, would be on the Columbia main stem. All of these run-of-river plants depend on upstream storage for winter water releases. The Hells Canyon reservoir would serve an important but modest flood control function; however, power is by far the major purpose. This means that nearly all the costs of the project would be repaid, inasmuch as power is a reimbursable function. Any surplus power revenues would be used to help defray the irrigation costs of the proposed Mountain Home Project, but there is no physical connection between the Hells Canyon proposal and irrigation.

The main purpose of the Hells Canyon proposal, thus, would be to store water which would be used for power production at the site and at the run-of-river plants downstream during the winter low-flow period. At present, three of the six planned reservoirs have been completed, Grand Coulee, Hungry Horse, and Albeni Falls, providing not quite half of the 20,000,000 acre-feet of storage capacity considered necessary by the federal agencies concerned. With the six reservoirs and the planned downstream plants, approximately thirty per cent, 10,000,000 kilowatts, of the Columbia's power potential would be realized. This would quadruple the present prime power capacity of the Federal Columbia River system.

On the other hand, the Idaho Power Company is proposing to construct either a series of five smaller run-of-river power dams or, more recently, a three-dam plan with 1,000,000 acre-feet of storage behind the topmost dam. The three plants would have an aggregate installed capacity of 783,000 kilowatts, of which perhaps three-fourths would be prime power. The private development would require a much smaller total investment than the federal project and would be financed in the convential commercial manner rather than by the federal treasury. Taxes would be paid on the properties and income of the private development. The first and smallest of the three dams could be generating power within probably two years from start of construction, whereas it would be a minimum of four years before the federal project could make a power contribution. Moreover, in view of the needs for military expenditures, the Congress is not willing to appropriate money at the present time for large domestic investments.

In view of these considerations, it does not seem surprising that Secretary McKay withdrew the Interior Department's opposition, filed in June, 1952, to the Idaho Power Company's application for a license for its proposal. This amounts to endorsement of the Idaho Power proposal by the Secretary of the Interior although, of course, the Federal Power Commission has the licensing authority. Space does not here permit a detailed analysis of the specific arguments which were the basis of Mr. McKay's decision; such an analysis has been undertaken by the author in a paper to be published in Pacific Northwest Industry. The present paper will be confined to a treatment of some of the possible long-range implications which may make the McKay decision an important statement of resource development policy rather than an isolated verdict. As Interior Department resource policy, the issue transcends both politics and economics and comes within the logical purview of geographers.

Resource Policy Implications

Discussing implications is, like any other form of prediction, a hazardous enterprise. I claim no prophetic infallibility; events may prove me wrong. It is to be hoped that any pessimistic prediction is proved wrong.

The first implication is, of course, that the decision re-establishes within the Department of the Interior a favorable climate for private enterprise in the hydroelectric power field. This is a development that most fair-minded observers feel is overdue, but it also imposes a corollary responsibility on private utilities to avoid the mistakes of a quarter century ago which reacted so strongly against them. From a resource management point of view, one of the mistakes to be avoided is underdeveloping a given site in order to maximize profits. Dam and reservoir sites are not ubiquit-

ous resources. To avoid waste of these resources every project should be designed to utilize fully the site potential up to the limits of reasonable, but not maximum, profitability. Without such a requirement, unnecessary costs may be incurred at a later period. The Hells Canyon reservoir site is one of the best big reservoir sites left in the western United States. The reservoir would inundate no railroads, highways, towns, agricultural land, or national park land. There is no other big reservoir site in the United States portion of the Pacific Northwest of which this is true. To utilize such a site with the run-of-river development first proposed by the Idaho Power Company would be questionable conservation. The modification of Idaho Power's proposal to provide for 1,000,000 acre-feet of storage is encouraging, but the question may appropriately be raised: would the plan have been thus modified if there had not existed the yardstick of a competitive federal proposal. Does re-establishment of a favorable climate for private power mean eliminating the federal government from the field? Elimination of the federal government would, presumably, eliminate the yardstick in future cases. It will be difficult to serve conservation needs without some sort of yardstick.

Another important implication is the profound effect Secretary McKay's decision may have on comprehensive basin planning. As noted previously, the Hells Canyon reservoir was a key proposal to provide storage for winter power production and occasional flood control use. The limited storage contemplated for the smaller development would be released on a schedule geared to the Idaho Power Company needs. Because the low-flows of the Snake and the Columbia do not coincide, and because the rest of the region's power plants would not be integrated with the Idaho Power plants, the latter's storage releases would not contribute to the downstream plants. Will the decision to release the Hells Canyon site to the smaller development mean that any comprehensive plan can be disrupted by turning over a key site to some noncontributory use? Under this threat, basin-wide planning, which has been accepted as a sound principle in stream development, would be difficult if not impossible. The alternatives are nondevelopment or the now thoroughly discredited single-project philosophy. Examples of wasteful single-project philosophy which may be cited include the attempts to control the Mississippi River merely by ever-larger levees and the failure to provide even the ground space needed for a third power house at Grand Coulee because additional upstream storage was not foreseen. Of the two alternatives, nondevelopment is probably the least wasteful, but this is so unpopular as to be politically unacceptable. There is a real danger that the nation will drift into an era of uncoordinated, local-focus water resource programs. The area or sponsor with the greatest political strength will get the appropriations and the water, regardless of overall needs.

Under such a philosophy, of course, it is impossible to plan soundly the number of downstream dams which can economically be constructed, because the engineers are unable to make reasonable assumptions as to stream flows available. Certainly all five dams planned for construction downstream from Hells Canyon should be carefully reexamined. Inasmuch as half of the estimated prime power capability of the four Lower Snake dams is attributable to Hells Canyon storage, there is reasonable doubt that these four dams would be economically feasible in the absence of Hells Canyon storage.

This brings us to the consideration of another of the implications of the Hells Canyon decision: the effect it may have on the problem of

augmenting the low power production in the Northwest during the winter months when the flows of the Columbia and other important power streams are low. Several alternative methods are available to meet this problem. The alternative selected by the federal agencies was, of course, to expand the program of large, multipurpose, upstream reservoirs which was begun in the Northwest with the construction of Grand Coulee Dam. As noted, six reservoirs, including Grand Coulee, were recommended. Two, Albeni Falls and Hungry Horse, have been constructed in the post-war period. Three more--Hells Canyon, Libby (Kootenay River), and Glacier View (North Fork of Flathead River)--have not been started for various reasons. These sites were selected from among many alternative sites. If the comprehensive basin plan is to be carried out, equivalent substitute storage space must be provided for any of these three reservoirs eliminated. Glacier View, practically speaking, has already been dropped from the plan because of the objections of national park and wildlife interests. The substitute sites were all eliminated in the formulation of the plan because they involved either greater costs or serious inundation problems involving communities, transportation routes, agricultural lands, or other resources. If the Hells Canyon site is dropped, there may be increased pressure to utilize one or more of the earlier-rejected sites, all of which were viewed by the federal agencies as entailing greater cost than Hells Canyon, either in direct or in social costs. Particularly, there may be strong pressure to use those sites which were previously dropped from consideration because of the potential damages to fish and wildlife resources. Specifically, this includes the Glacier View and Nez Perce sites. Glacier View would inundate an important amount of winter range for the deer, elk, and moose population of Glacier National Park. Nez Perce would block the very important salmon migrations in the Salmon River, which is one of the most important salmon spawning streams in the Northwest.

There are reported to be several attractive storage possibilities in the Canadian portion of the Columbia River Basin. One or more of these may well provide the desirable equivalent storage, and careful studies of the possibilities are warranted. It should be noted, however, that the inundation problems may be relatively even more severe in interior British Columbia than in the United States because the amount of valley land available for agriculture and other economic uses is sharply limited.

Thermal generation is, of course, an alternative to storage as a method of firming up winter power production. At present thermal generation is not considered economically competitive with hydropower in the Northwest, partly because of high fuel costs and partly because of the long season during which the stream flows are high and the thermal plants would be idle. Under present cost conditions, resorting to thermal generation would mean sacrificing one of the significant comparative advantages of the Northwest. As the less expensive hydropower sites are developed or become unavailable, however, thermal generation will approach cost equality with hydro-generation.

Another possible alternative to major storage is additional imports of energy into the region, including natural gas and petroleum by pipeline and perhaps, as has been suggested in some quarters, electricity generated at mine-mouth, coal-burning plants in the Crowsnest area of southern British Columbia and Alberta. These possibilities, however, are considered supplementary to hydroelectric power rather than as alternatives.

Still another alternative is the one suggested earlier, nondevelopment. This, of course, means adding no further electroprocess industries in the Northwest. This has actually been established policy, with occasional exceptions, since the post-Korean industrial expansion began in 1950 and is today being rigidly applied except for those industries which are able to use interruptible and seasonal power. Continuation of this policy would gradually bring power supply into balance with demand. It would also put greater pressure on energy resources elsewhere in the United States as for example, the demand for natural gas by the new aluminum plants constructed in the Gulf South, or result in increased imports from Canada and elsewhere of electrochemical and electrometallurgical products. Increased imports of such products may well be both economically and politically desirable.

Without one or more of these alternative solutions being applied, the Pacific Northwest will continue to face recurring winter power deficits except in those winters of above-average stream flow. Without further upstream storage, only a small fraction of the Columbia River's total hydropower potential can be realized, regardless of the number of run-of-river plants constructed. Moreover, the economic desirability of the run-of-river plants is lessened in the absence of adequate upstream storage.

There is at least one more important implication of the decision. The Bureau of Reclamation, at least, regarded the lucrative federal power projects as a source of financial assistance for potential irrigation projects, which, with few exceptions, are not financially feasible under current repayment criteria. This irrigation subsidy was the major reason that the Corps of Engineers acceded to the Bureau of Reclamation's assertion of primary responsibility for the proposed Hells Canyon project. The Bureau envisaged expansion of this concept to the other federal power projects in the Northwest. The concept is already being applied in the case of Grand Coulee Dam, and legislation has been passed extending it to Chief Joseph Dam. If financial assistance for irrigation is not made available from power, other forms of subsidy will be required or the federal reclamation program must be halted.

Conclusions

Careful examination of the issues leads to the conclusion that the long-run implications have not been adequately considered in Secretary McKay's Hells Canyon decision. The present economic climate is certainly unfavorable for investment in an expensive upstream storage project, and the Pacific Northwest does need immediate power. But climates fluctuate, and the small first-phase of the private development will not make any significant amount of power available to those load centers where a power deficit actually exists. In the long-run view, the use of a superior reservoir site for only a partial development violates sound conservation principles, and may establish a precedent for disrupting any long-range, comprehensive, basin development program.

To the geographer, who is keenly conscious of the weaknesses of sectionalism, it is disturbing to see a local project given precedence over the broader needs of an entire region. Though the specific elements of the Hells Canyon controversy may make this expedient, it would indeed be regrettable if the Department of Interior and other federal resource agencies adopted this view as policy. The local-project philosophy is inadequate in managing water resources which have an essential unity extending over broad regions.

Perhaps the most disappointing conclusion to be drawn from the McKay decision is that the new administration does not have a water resource policy which combines the desirable aspects of the large federal program with the advantages of private entrepreneurship. If the scale of the big projects, such as the federal Hells Canyon proposal, is too large for private enterprise, must the projects be made smaller as the only alternative to federal construction? Might it not be wiser to enlarge the scale of private enterprise? By permitting and encouraging mergers of private power utilities, their markets and financial resources would be enlarged and they could more easily undertake projects of regional rather than local scope. Larger private utilities, having greater equality, could participate more effectively in cooperative programs with the federal government and the large municipal utility systems. This in itself would have the effect of establishing a more equitable climate for private enterprise. It is neither too late nor too unreasonable to ask for imaginative administration in the field of water resources. The problems of controlling and using our rivers are too complex and too important to meet them with policies which, with the political climate of the moment, swing like a pendulum from one extreme to the other.

THE ASSOCIATION OF PACIFIC COAST GEOGRAPHERS

Sixteenth Annual Meeting

Santa Barbara, California, June 18 - 20, 1953

The sixteenth annual meeting of the Association was held at the Alhecama Theater, Santa Barbara, in connection with the annual meeting of the Pacific Division, American Association for the Advancement of Science. Four half day sessions were devoted to research papers, with a business meeting included on Friday morning, June 19. An all-day field trip occupied Saturday, June 20. Led by Richard Logan and Marvin Mikesell, a field excursion covered the coastal fringe of southern Santa Barbara County during the morning, and the southern portionsof Ventura County during the afternoon. The address of the retiring President, William A. Rockie, was given at the annual dinner meeting held on Thursday evening, June 18.

Program, with Abstracts of Papers Presented.

JOHN C. ALBRIGHT, JR. The Petroleum Industry of the Los Angeles Lowlands. University of Southern California.

After 1890, when drilling led to the Puente Hills Field, the Los Angeles Lowlands became a major United States petroleum area. Despite the rise of new fields in midland America, over five per cent of the nation's liquid hydrocarbon production flows from 31 major fields of the Lowlands.

Developments since 1941 include over 500 new wells and production from depths below 12,000 feet. More than 1,000 new wells are located in the Wilmington Field, second largest nationally. In spite of increased production, markets have necessitated 1952 importation of an estimated 20,000,000 barrels of foreign crude.

The Lowlands' processing plants have over ten per cent of the national capacity. With two million vehicles in metropolitan Los Angeles, hundreds of wholesalers and thousands of retailers supply local petroleum markets. This large demand requires importation of additional crude from other California fields. Besides traditional products, various petrochemicals have been added. The petroleum industry remains a major economic force in the Los Angeles Lowlands.

Esthetically, some feel the importance of the industry has not compensated for landscape blighting in areas like Venice and Signal Hill. By contrast are Union Oil Company's newly conceived "drilling islands."

HARRY P. BAILEY. An Equal Area Grid Formed of Meridians and Parallels. University of California, Los Angeles.

An equal-area grid developed may be formed by meridians and parallels so spaced that the quadrilaterals formed by their intersections remain equal in area over all parts of a spherical earth. Such equality can be achieved by maintaining the conventional spacing of meridians but respacing the parallels in conformance with the principle that the area of a zone on a sphere is proportional to the altitude of the zone. Consequently, with the equal-area grid the parallels are most closely spaced near the equator, and farthest apart near the poles.

For world maps of atlas size, subdivision of each hemisphere into 100 elements, or 400 elements, is advised as those schemes define areas of convenient size, approximately 1,000,000 square miles, and 250,000 square miles, respectively. The quadrilaterals will be delineated in their true areal relations if shown on an equal-area projection. When used on projections that distort area, such distortion will be revealed by the equal-area grid. In either case, approximate measurement of the areal extent of mapped objects can be carried out by reference to the grid.

HARRY R. CALDWELL. Recreational Land Use in the North Idaho Lake District. University of Idaho.

Recreational land-use patterns are closely related to changing regional economics, urban-rural occupance patterns, site conditions, accessibility, and social fads. In the northern panhandle of Idaho, distant from an urban center and possessing limited shoreline access, Lake Pend Oreille has achieved national recognition amongst fishermen because of its blueback salmon and giant rainbow (Kamloop) trout. There now is concern as to the probable effect of the Cabinet Gorge and Albeni Falls dams on the future fish population. This problem has been made even more complex by making the lake part of the storage reservoir behind Albeni Falls dam and by changing lake levels to provide greater flood protection and greater downstream hydroelectric power output. From 1920 to 1951, the number of watercraft on Pend Oreille increased five fold, from 45 to 221, with Bayview accounting for over half of the total number. Even more spectacular has been the increase in floathouses. With living quarters in the front portion and a boathouse in the rear, these floathouses represent the house trailers of Pend Oreille. In 1920 there were less than six on the lake. Thirty-one years later more than 75 were counted, with the Bayview area accounting for almost all of them. Over half of these floathouses have been built since 1940.

In the same region Spirit and Hayden Lakes are easily accessible smaller lakes relatively close to metropolitan Spokane. From comparative studies of these two lakes it is readily apparent that the pressure for summer home developments on the more accessible lake shorelines is intense and that most of the better sites have already been preempted by private homes. Except for Lake Pend Oreille, public access sites have been relegated to undesirable shore sites or are wholly absent. As the desirable waterfront sites have been developed, subsequent private developments have taken place on waterfront sites with back-shore slopes up to 35° or relatively flat areas behind the most accessible sites.

WOODROW R. CLEVINGER. Locational Trends in the Douglas Fir Lumber Industry: A Study in Forest Economic Geography. University of Washington. Published in full in this issue.

GLENN CUNNINGHAM. The Tin Can Industry of California. American Can Company. Published in full in this issue.

DONALD J. DABNEY. Beverly Hills, California: An Exclusive Residential Enclave. University of Southern California.

Beverly Hills, an exclusive residential enclave within Los Angeles,

possesses separate political functions, yet relies economically upon the surrounding community.

The city has three obvious residential districts. A large estate district lies north of Sunset Boulevard; a luxurious district, but with smaller properties, adjoins the above on the south, while below Santa Monica Boulevard is a more complex third district. All three have such common features as hidden telephone poles, tree-lined streets, paved alleys, well-maintained properties, and buffer zones protecting residents from major thoroughfares.

A small fraction of Beverly Hills in non-residential. Half of this area, containing two-thirds of the retail establishments, lies within the "Business Triangle". Most shops are small, selling expensive specialties. The minute industrial zone, with a Southern Pacific spur line, contains the service activities necessary to maintain an independent community.

FRANCES M. EARLE. The Evolving Transportation Pattern of the Pacific Northwest. University of Washington.

Physically isolated from the settlements of eastern United States by the barriers of distance, mountains, and desert, the Pacific Northwest was for many years oriented toward waterways. Two major routes of access were by sea to Panama thence to Puget Sound, or overland by the Oregon Trail following the Snake and Columbia Rivers.

Transcontinental railways opened up the vast interior, stimulating both settlement and agriculture; roads developed slowly. While the large scale exploitation of forests and the development of irrigation agriculture created new demands for roads, hard surfaced highways belong to the twentieth century. The growing highway system and the increasing use of motor vehicles caused many settlements to be reoriented.

The passenger function of the two major navigable waterways gradually declined but their freight and service functions increased. Largely because of motor competition, railway mileage is decreasing although there has been no significant change in the pattern in two decades. Air transport, which has grown most rapidly, competes effectively with railroad, bus, and ship for long distance passengers and also handles a steadily increasing volume of freight, especially to Alaska and the Far East.

In general, all types of transportation tend to follow a similar pattern which is closely related to topography, economic productivity, and population distribution.

LYLE E. GIBSON. Land Use in the Urban-Rural Margin North of San Francisco. San Francisco State College.

Between the center of San Francisco and the heart of the agricultural-lumbering region to the north lies a regional margin in which urban-rural land use is competing. In this competitive zone commuter inhabitants are taking over the areas of city-supply agriculture, and dairying is absorbing land formerly used for grazing, orchards, vineyards, and chicken and egg production.

In the perpetual rule-of-thumb cost accounting, commuter homes pay more for the land than agriculture. The growing demand for fluid milk in San Francisco and the Bay Region has increased milk production north of San Francisco. Dairying, market gardening, and beef feeding on irrigated pastures are replacing both fruit and hop production, and chicken and egg production. Many orchards and vineyards are declining in production with old age. Chicken and egg production is falling because of the limited grain producing land and through competition from other areas.

The steady increase in fluid milk production relates to the good grass-and-hay-producing ability of the land in Sonoma County as well as to market accessibility. Rains of higher amount and longer seasonal duration along with the increased use of irrigation produce more profit to dairy farmers than the other varieties of agricultural production. Only urban land use appears able to replace extensive agricultural land use and change the trend.

DAVID A. HENDERSON. "Corn Belt" Cattle Feeding in Colorado's Irrigated Oases. University of California, Los Angeles.

Today on the northern Colorado Piedmont and in the Arkansas River Valley of eastern Colorado large scale farm production of beef cattle resembles a Corn Belt mixed farming economy. This trend toward the intensive production of beef cattle on irrigated farmlands and in feedlots contrasts sharply with extensive cattle production of the surrounding ranges, and may portend the future of the cattle industry in other western range states.

There are several factors responsible for this development. Increased national and western demands have brought additional feeding facilities into production to absorb greater numbers of cattle being sold off ranges. Colorado's dry climate irrigation produces high quality crops for cattle feeding. This aridity also reduces the danger of cattle disease and obviates deep mud in feeding pens, thereby increasing per-day cattle weight gains.

"Farmer feeders", who individually raise from 50 to 20 cattle each winter and "commercial feeders", who each fatten from 200 to 25,000 animals throughout the year, operate in Colorado's irrigated oases. Both utilize scientific production methods and rapid turnover to attain utmost efficiency. In spite of recent cattle price declines, this efficiency and the agricultural resources with which these farmlands are endowed appear to have permenently established a mixed farming economy on the irrigated oases of eastern Colorado. Being published in full in Economic Geography.

J. ROSS MACKAY. Post-Glacial Drainage Changes in the Darnley Bay Area, Northwest Territories, Canada. University of British Columbia. Published in full in this issue.

DONALD D. MACPHAIL. Land Tenure Problems in Southern Puerto Rico. Western Washington College of Education.

The semi-arid southern coast of Puerto Rico partially reflects

the land tenure situation of the whole commonwealth, and also presents additional problems locally. The area includes about one quarter of the island and its economy is primarily agricultural. Irrigated sugar cane is dominant on the dry coastal plain whereas cattle raising prevails in the semi-arid foothills. Aridity is a key factor in determining that sugar plantations and cattle farms are usually larger than similar farms in the remainder of the island. Although large land holding is common, the landless agregados and subsistence farmers comprise the bulk of the rural population in the area. Excluding the 12,662 agregados on the South Coast, about 78 per cent of the total 15,814 farms in the region are less than 9 acres in size.

The insular government has settled thousands of agregados on small parcels of land, but this program has achieved only limited success. Small cultivated plots are marginal at best without irrigation and worse yet on the steep slopes of the foothills. It is doubtful if the present government will do much to unbalance the sugar cane industry on the coastal plain which is now in the strongest economic position of all insular industries. Mechanized farming, and high irrigation cost would further discourage the increase in small holdings, in spite of the intense pressure on the land originating in the huge rural low income group.

MARION E. MARTS. Water Resource Policy Implications of the Hells Canyon Controversy. University of Washington. Published in full in this issue.

HOWARD H. MARTIN. Metropolitan Seattle: Site Versus Situation. University of Washington. No Abstract Received.

DONALD W. MEINIG. Walla Walla to Liverpool: Problems in the Export of Columbia Basin Wheat, Circa 1880. University of Utah.

The development of a foreign export outlet for Columbia Basin wheat constituted the greatest milestone in the economic history of the region, as it laid the foundations for its ensuing development into one of the world's great wheat specialty regions. The problems of forging this link with a remote market were many and complex. They involved farm handling methods, overland and river transport, transshipment, and ocean shipping. Grain moved by wagons to loading docks along the Columbia River, downstream to Portland on river boats, into ocean ships and by the Cape Horn route around South America to Liverpool, a trip of some 15,000 miles. This paper is being published in the Pacific Northwest Quarterly.

WILLIS B. MERRIAM. The Geography of Humboldt County, California. Washington State College.

Though restricted by chilling summer fog, mountainous topography, limited arable soils, and isolation, Humboldt County has experienced a population increase of more than fifty-one per cent during the past census decade. Reasons center mainly on a resurgence of lumbering. In 1940, 18 mills cut 314,000,000 board feet valued at $13,000,000. In 1951, 262 mills cut 1,250,000,000 feet valued at $100,000,000. With 46,000,000,000 feet of standing timber, forty per cent redwood, lumbering is far and away the leading industry.

Agriculture is second, with livestock, dairying, and specialty crops valued from $12,000,000 to $16,000,000 annually. Expansion, however, is limited by soil restrictions and high clearing costs. Commercial fishing ranks third, totalling $13,000,000 from solefish, crabs, salmon, and 25 minor varieties. Recreation and tourism, based on redwood forest sites and sport fishing, is fourth in economic importance.

Recent growth is largely exploitational and must be recognized as a boom development that probably will not continue at the same rate through the next decade. However, in no field locally adaptable, except mining, is the county facing seriously limiting or closed resources.

MARVIN W. MIKESELL. The Changing Role of the Port of Santa Barbara. University of California, Los Angeles.

In sixteen and a half decades of Occidental settlement the port of Santa Barbara witnessed intermittent visits of Spanish supply ships, a prosperous hide and tallow trade, a period of relative neglect, and a modern function as anchorage for fishing and pleasure craft. During the period of Spanish and Mexican control only three of California's mainland ports, San Diego, Monterey, and San Francisco, could be considered safe throughout the year. The others were "open roadsteads", reasonably safe in summer but exposed during the rest of the year to treacherous gales. Santa Barbara's role as an entrepot in late colonial times thus reflected economic rather than natural advantages. From the trader's viewpoint rich hide and tallow cargoes and a favorable rate of exchange more than compensated for exposure and rough surf.

Under the impact of Anglo-American settlement and the drought of 1862-64 the pastoral foundation of the hide and tallow trade collapsed. With mutual profits no longer attainable, Santa Barbara's commercial function ceased. Completion of a breakwater in 1930 did not alter the situation, for orchard and field crops developed since the turn of the century have found effective outlets via road and rail. Modern emphasis upon pleasure craft is in large part a reflection of the city's growing role as a tourist and retirement center. On a small but meaningful scale, the varying appraisal and realization of Santa Barbara's maritime opportunities offers a clue to the historical geography of the southern California littoral. Here, as elsewhere along the coast, commercial history is closely correlated with broader regional trends.

HOWARD J. NELSON. Some Thoughts on Urban Morphology. University of California, Los Angeles.

Urban geography in America is not only a youthful and immature discipline; it is under-manned and is progressing only slowly toward maturity.

American geographers might well investigate the field of urban morphology, the study of the anatomy of the city. Almost nothing has been done from this viewpoint in our American culture realm.

Urban geographers should ask "why" after our usual "conclusions" have been reached. Geographers find, for example, that the city retail district is located at the focal point transport and in the area most accessible

to the greatest volume of purchasing power. But, as Firey says, the problem is then, "why retail business in general, and certain kinds in particular are found in the area of maximal accessibility, and further, why the retail store as we know it exists at all."

American urban geographers have done little work in the comparative study of the cities of the various culture realms of the world. After a considerable number of comparative studies of cities have been made, in the manner suggested above, we should have as valid insights into the culture of regions as is possible to gain by any other method.

And all of this, I believe, can be accomplished without losing our present ability to function usefully in the modern city. Our cities are in need of new ideas for the urban landscape. As the botanist has enriched the reservoir of useful plants through an analysis of the floral patterns of the world, so the geographer may be able to add to the pool of ideas of urban form and structure through a deep understanding of the morphology of the world's cities.

ROBERT M. NEWCOMB. The Place of Spice Culture in Pre-European Oriental Agriculture. University of California, Los Angeles.

In the course of unraveling the origins of Pre-European Oriental Agriculture, the question arises as to whether or not commercial agriculture, that is farming beyond the level of mere subsistence production, ever existed in Southeast Asia. Spices could have provided crops suitable for such cultivation. In a study of this question several assumptions must be made regarding the state of post-Neolithic acquaintance with spices, and the trade capabilities of that time.

In Southeast Asia there are four centers of spice origins to be considered; the northeast Himalayan foothills, the Malabar Coast of India, South China, and the Malay Archipelago. The cultivation of spices was concentrated in these areas, and it was from them that use patterns, stimulating to spice production, were derived. The dissemination of use patterns throughout Southeast Asia and later into Europe stimulated market demands for spices, which demands were answered by means of increasingly expanded trade patterns among the growing, centralized political powers of the East.

As a result, "cash-cropping" of spices developed. Under this arrangement a nearly self-sufficient food producer raised various spices on the side. Upon a limited basis he traded these products for foodstuffs or received cash payments. Prior to the appearance of European traders in Southeast Asia, commercial, mono-crop plantation cultivation of spices did not obtain. India and the Malay Archipelago were the scenes of a greater amount of this limited, cash cultivation of spices than was South China.

LAUREN C. POST. Revolution in the Beef Cattle Industry in the Southern United States. San Diego State College.

Each year more and better beef is produced in the South. The development in beef production, even when judged by national standards, is revolutionary as a geographical and economic feature.

In this area to which European cattle were introduced and which was not good native grassland, the beef industry was carried on in an inefficient manner until about a quarter of a century ago. Poor grasses, uncertain winter grazing, hot summers, pests, diseases, and insects handicapped the industry. Lack of scientific and practical know-how, as well as plain indifference were cultural handicaps.

Eradication of tick fever about twenty years ago made possible the introduction of good quality beef breeds of European cattle. The introduction of Indian Brahman cattle made possible a productive cross-breeding program. Modern grass farming introduced or created more productive and more nutritious grasses. Grass became a cultivated crop that demanded and made profitable the use of lime and fertilizers. New lands were cleared by mechanical means and abandoned plantations were brought under the new system of grass farming. Mechanization in both the planting and haying phases of the industry held down demands on labor and made possible easy clipping of pastures to prevent weeds and forests from retaking pastures. Agricultural and industrial colleges, experimental stations, and high schools have developed everywhere programs of study and research. Cattlemen's associations, breeders' organizations, fairs, and stock shows, also have contributed.

The South still has much land which can, with some expense, be turned to a cattle industry which produces many times as much beef per acre as does the arid west.

JOHN W. REITH AND GERTRUDE M. REITH. Causes of Coal Mining Decline in the Danville District, Illinois. University of Southern California.

The Danville District, lying some 125 miles south of Chicago, has a natural geographic advantage in supplying the greatest single coal market in the world: Chicago. After a slow steady rise in the District's production into the 1920's a much more rapid decline set in so that by 1946 the coal industry was practically extinct.

Factors which caused this decline are manifold, but can be divided into those which operated from within the district and those operating from outside the district. Internal factors include such items as a coal quality and high cost of mining owing to lack of mechanization and reputed poor mining conditions. From without, such factors as the competitive situation with other districts in coal quality, mining costs, and transportation methods as well as the captive nature of the major mines have been important.

J. LEWIS ROBINSON. Agricultural Regions of British Columbia. University of British Columbia.

British Columbia is a mountainous province in which the amount of level land suitable for agricultural production is quite limited. Similar to the rest of western North America, the provincial population increased by forty per cent in the past decade. Already British Columbia does not feed itself in several of the staple foods, and therefore the utilization of the small areas of suitable land for agriculture is important to the growing population.

Because of the variety of landform and climatic regions, there are wide differences in agricultural production and in potentialities for expansion. The lower valley of the Fraser River has the largest blocks of cultivated land. Being favored by a mild and wet climate, and with nearly half the provincial population concentrated in Greater Vancouver, agriculture emphasizes dairying, truck gardens, poultry, and small fruits. The interior southern valleys are quite dry, so irrigation is required. Hot, clear summer days aid in the production of high quality stone fruits. The interior upland or plateau regions cannot be irrigated, and therefore remain in grassland, and are the basis of the cattle-ranching industry.

The central part of the province has smoother topography and a more effective precipitation regime. The region is now developing a mixed farming-livestock economy along the few major transportation lines. It has the largest blocks of potentially arable land, but at present is too far from market centers. The Peace River region east of the Rocky Mountains produces grain and legume seed similar to that of the northern prairie Provinces, but the amount of arable land is notably less than in the regions to the eastward. The northern half of British Columbia has no agriculture and is virtually unpopulated.

British Columbia can never become an agricultural province, but it can expand its agricultural area if given improved transportation. There are one and a quarter million acres now under cultivation. Estimates suggest from six to nine million acres of potentially arable land. This potential is less than four per cent of the provincial area, and indicates the agricultural problem which the growing population of this mountainous province must face.

HOMER LEROY SHANTZ. The Place of Grasslands in World Vegetation. Santa Barbara College. No abstract received.

BENJAMIN E. THOMAS, Constantine, Algeria: Fortress and Trade Center. University of California, Los Angeles.

Abstract. Constantine has a site that has been used continuously through all periods from pre-Roman times to the present. Moreover, it has never ceased, throughout all its history, to be an important market and the capital of a kingdom, a confederation, or a province. Under the Romans, Constantine, at first called Cirta, was an important junction of paved roads and the capital of Numidia. Although the Roman Empire declined and the roads fell into disrepair, Constantine continued as an important center for the Berbers, Vandals, Arabs, and Turks. The French, beginning in 1830, built a new system of roads and reinforced it with railways. The pattern is strikingly similar to the former Roman one, and Constantine occupies the same focal position in eastern Algeria.

The durability of Constantine is partly owing to its situation at the junction of the Mediterranean and steppe climatic regions. It is the historical place for the exchange of farm produce of the north for pastoral products of the south. Likewise it is centrally located on the high plains with convenient passes through the mountains to adjoining regions. Probably it is the protected site on a flat-topped upland with canyons or cliffs on almost all sides that has made it especially attractive in a land where nomadic raids and warfare are traditional features. Constantine is an

outstanding example of a spectacular and unique situation and site that has attracted many people of varying cultures to use it as a fortress, trade center, and capital.

LAWRENCE C. THOMPSON. The Baldwin Hills, An Island in the Los Angeles Metropolitan Lowland. University of California, Los Angeles.

The Baldwin Hills, comprising about ten square miles of uplands located approximately eight miles from downtown Los Angeles, have had a different development from the surrounding lowland. Heterogeneous economic utilization has produced a distinctive landscape although the Hills have topographic unity. Urbanization encroached against without encompassing the Hills; thus, the Hills have evolved into a cultural island.

The Hills are a single topographic unit bisected by a rift along the Newport-Inglewood fault. The eastern segment is becoming an upper-class residential area while the western segment remains more rural. The western segment became the site of the Inglewood oil field with its western margin acquiring inferior commercial, residential, and manufacturing functions.

Historically, the Hills once contained segments of several ranchos used for grazing; later activities included agriculture, oil exploitation, and marginal urbanization. The surrounding lowland became part of metropolitan Los Angeles leaving the Hills largely rural. Now the Hills, too, are rapidly being engulfed by urbanization. Yet they have acquired certain unique social, economic, and political aspects.

EDWARD L. ULLMAN. The Basic-Service Ratio and the Areal Support of Cities. University of Washington.

By definition basic activities of cities are those producing goods or services for sale outside the city. Service activities are those carried on for internal urban consumption only. Basic activities, in a sense, support service activities. This is commonly measured by comparing the number of basic employes, those working for an export activity, with the number of service employes, those working for internal consumption. Other terms used in other studies synonymous with basic are: primary, supporting, urban growth, export and external; synonymous with service are: secondary, non-basic, local and internal.

Following are some tentative conclusions:

1) Refinement of the technique of comparing cities through developing a standard manual of procedure would be desirable so that comparisons between cities would be more valid.

2) On the basis of present uncoordinated data, however, the ratio for cities of more than 10,000 population appears fairly certain to lie between 1 basic to 0.5 service and 1 basic to 2 service workers.

3) The larger the city, all other things being equal, the larger the service component apparently should be. The drop in service, however,

appears greatest below 5,000 population. Finding the approximate size at which the ratio of service goes up sharply may well provide another indication of the minimum optimum size of a town.

4) Discovering the specific basic activities in which the city's livelihood is concentrated enables one to relate future prospects of the city to national trends in specific industries.

5) Some sort of allocation of basic employment to specific support areas, whether source or market, or possibly a weighted composite, is desirable in order to reap full benefit from the concept. The city then can better assess the effect of changes in surrounding areas whether based on new resources, immigration, changed transport facilities, or other factors.

Abridged Report of the Secretary-Treasurer

On June 1, 1953 there were 227 association members, 57 of whom were delinquent. There were 199 regular and 28 student members. This represents a net gain of 14 over the total for the preceding year. There were 55 libraries on the regular subscription list. A very few full sets of the Yearbook still are available.

Detailed settlement of the eastern boundary of the proposed Pacific Coast Division of the Association of American Geographers must still be worked out with neighboring regional divisions. Final agreement is subject to action by the AAG Council.

Income Deposits		Withdrawal of Funds	
Bank balance June 17, 1952	$ 361.88	Printing Yearbook, Volume 14	$ 505.75
Current & Delinquent Dues	512.00	Postage	34.57
Yearbook sales	144.96	Telegrams	3.21
Miscellaneous contributions	13.04	Miscellaneous supplies	44.69
		Total Withdrawals	$ 588.22
Total Deposits	$1,057.88	Bank Balance June 1, 1953	$ 469.66

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President, James J. Parsons, University of California, Berkley.

Vice-President, H. Bowman Hawkes, University of Utah.

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